growth, inadequate capacity will be available for Summit's ultimate potential and a relief may be necessary.

12-inch (Beaver Run Interceptor Extension):

A meter was placed in the 12-inch sewer tributary to the 18-inch immediately downstream of Washington Street. It was found to contribute 17% of the average flows in the 18-inch and 21% of the peak flows. This results in a flow of 1.09 MGD with a 1-year frequency. No additional population growth is expected in this area. This is almost exactly equal to its theoretical capacity of 1.08 MGD. A 25 or greater year storm would add 0.15 MGD. From Figure VIII-e it can be seen that there will be a surcharge to within 3 ft. of the rim in the manhole housing the meter due to downstream capacity problems. Pebbling evidence of surcharge was seen within 5 ft. of the rim on April 2nd.

10-inch:

The 10-inch pipe observed peaks varied between 1.5 MGD and 0.4 MGD depending on precipitation. Flows averaged 0.41 to 0.6 MGD during the period studied. The capacity of the 10-inch is 0.65 MGD.

If storm flows equaling a 1-year frequency occurred presently during a peak flow condition, flows equaling 9.1 MGD could be anticipated at the station. At the present flow percentage of 18%, the 10-inch peak flow would be expected to equal 1.64 MGD. Adding growth peak flows could increase by 0.08 MGD giving an anticipated peak of 1.72 MGD. Thus, it does not have capacity to handle existing or anticipated flows.

Presently the Millcreek Township Sewer Authority has let a construction contract to relieve the 10-inch on Zimmerly with a 15-inch intercepting flows from 53rd Street. The sewer's design engineer estimates the flows expected from the two Zimmerly sewers at 2.07 MGD.

24-inch:

The 24-inch sewer was installed to take Summit flows and Millcreek flows. Its capacity equals 10 MGD over its entire length and 6.5 MGD at its minimum point. Present flows approximate 22% of Kearsarge flows. This is almost entirely Summit's contribution on Rt. 19. Flows over the past six months have peaked between 1.7 and 0.7 MGD depending on precipitation. At a peak one-year frequency storm flow of 9.2 MGD, its present expected peak would equal 2.0 MGD. Adding the ultimate growth projected flows, the total equals an anticipated peak flow of 3.6 MGD (3.9 MGD using 2.3 MGD peak flow which Summit has agreed to). Even if flows reached levels estimated for a 50 to 25-year frequency flows during saturated or frozen ground conditions (increase of 1.0 MGD total or .22 MGD in the 24-inch), 6.8 MGD capacity would remain in this sewer.

Meters

When the Kearsarge pump station investigation first began, it was found that the circular chart was unable to record peak flows at the station. The recorder was set to record a range of flows between 0 and 5,000 gpm. This range is within the design range of the two pumps (0 – 4,000 gpm) but it appeared that the pumps were operating above their design point. The chart recorder range was adjusted to 0 – 10,000 gpm and the circular charts were replaced with the appropriate equipment. Also at that time the meter was evaluated by the manufacturer's representative and was found to be operating within its specifications.

This allowed the flows to be recorded at the upper range of the pumps. At that range flows of 6000 to 7,000 gpm were noted with pressures of 50 psi. Friction factors calculated for those flows and a 16-inch pipe resulted in extremely low values (> 140).

It was also noted that at peak flows the rate fluctuated greatly. Because of the configuration of the discharge pipe (whose discharge was at a lower elevation than the wet well), it was first concluded that at high flows a siphon developed which helped the pumps by lowering their discharge head and allowing them to operate at the far right of their curves. Although conditions were such that a siphon may have been possible, there were inconsistencies. Primarily there was no wet well height fluctuations consistent with a siphon.

Thus, in October, 2002, three meters were installed on the influent flows to the station. The intention was to confirm the accuracy of the pump station meter and the existence of a siphon. Problems with such units are their inaccessibility to allow collection of data in a timely manner. The data collected in the first month showed the station meter to equal 128% of the influent values (Figure VIII-f). Once the evaluations were confirmed, arrangements were made to add a third meter to serve as the referee. That meter was a new generation of the same meter in the station and it was installed in the up leg of the discharge main. Its values were readily observable, but it gave an even greater deviation with the existing pump station meter than the influent meters gave. By then the second full month of the influent meter operation confirmed the first month's differential.

After a month of operation the test meter was moved to the location of the original meter (January 8) and the two operated together. Immediately the two meters began reading at the same relative discrepancy that the influent meters and the original Kearsarge meter had read over what was now a three- month span. It was felt that the test meter readings had corrected because of the new location and a new meter was ordered to replace the pump station meter (a magmeter is the optimum unit but bypass of the force main would be required for its installation). However, when the influent meters were read in February, it was discovered that the original older meter was the unit whose readings had changed (most likely due to interference) and it was now reading almost exactly the same as the total of the influent meters. The test meter continued to read low.

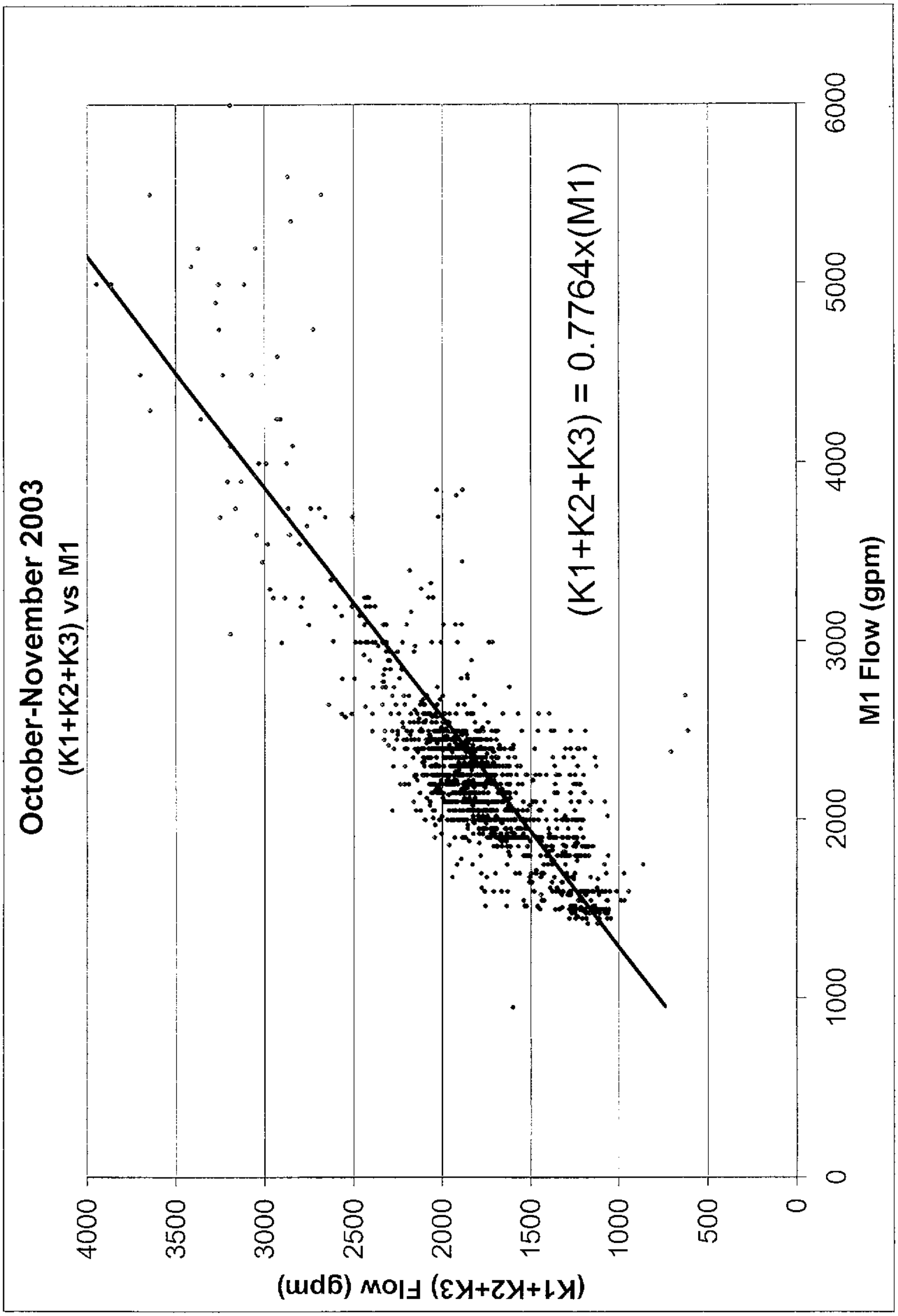


Figure VIII-f

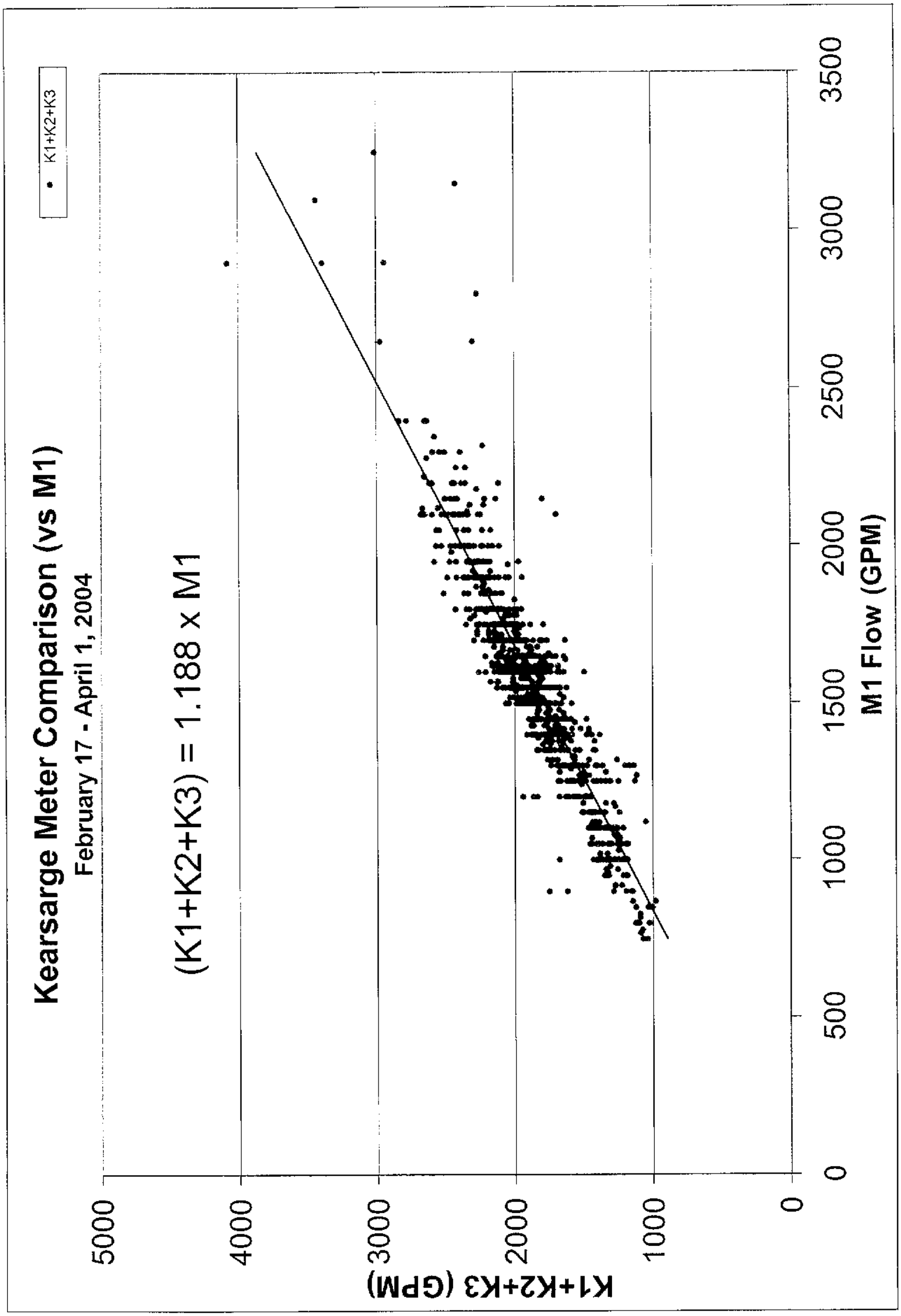


Figure VIII-g

The new meter was still installed on February 17, 2004, as it was assumed that both the old meter and the test meter were erroneous. It was not until the influent meters were downloaded on March 1st that it was determined that the new meter was now reading 84% of the influent meters. As a last resort, a drawdown test was attempted at the station on March 10th (Figure VIII-h). The flow calculated by drawdown (wet well and surcharged sewer volume displaced) equaled 125% and 121% of the meter flow (80% and 83% of the drawdown calculation). Influent flows equaled 2,000 gpm by drawdown calculations. Once influent flows by the influent meters were available, they revealed flows equating 1,900 gpm during the drawdown.

It, therefore, is concluded that the influent meters are nearly correct and that station discharge readings prior to January 8th should be adjusted downward by 22% and after February 15th should be adjusted upward by 20% (the station meter will be adjusted to read correctly once existing testing is complete).

Miscellaneous

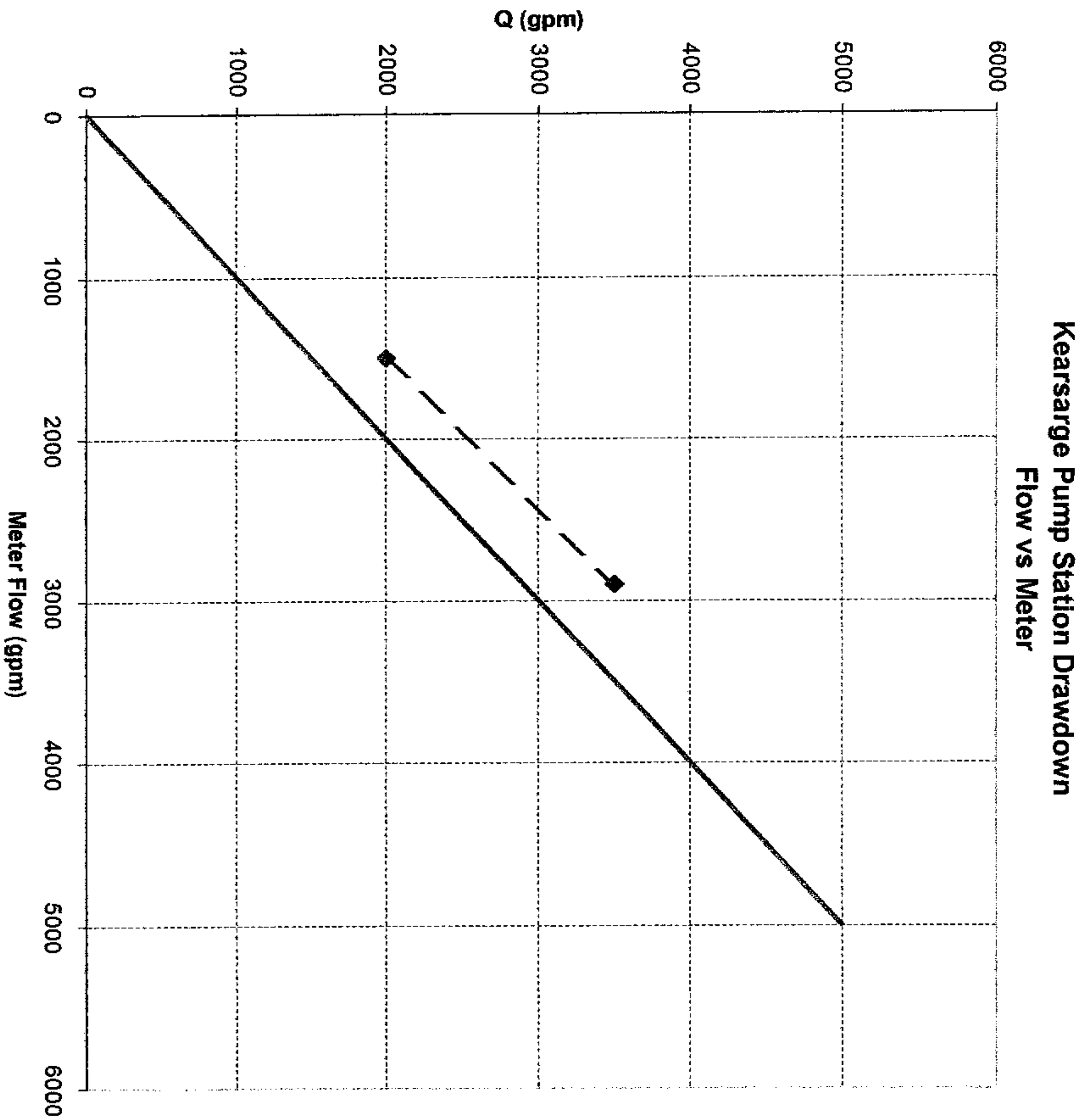
This pump station is located at a surface elevation which exceeds the elevation of some of its users' basements on 51st, Dixson Drive, and Enfield Lane. Basements on these streets have flooded due to sewer capacity problems in the 10-inch on Zimmerly and due to pump station surcharges above the basement elevations. A study identifying the houses subject to flooding is found in Appendix B-2.

As the wet well floods, it backs up flow in the incoming sewers to levels which will flood basements west and north of the pump station regardless of flows in the sewer. Figure VIII-i demonstrates the levels in the wet well which demonstrates levels at which surcharges will first match basement elevations.

Although wet well surcharges do not create flooding problems east of the station, they will compound problems due to flows exceeding the capacity of the sewers. For every foot of surcharge in the station, surcharges in the influent 18-inch, due to flows in the sewer, will be increased a like amount. Even with the 18-inch flowing at capacity, a surcharge of the station to ground level will create overflow possibilities. Figure VIII-j demonstrates the impact of the wet well surcharge alone and then with the sewer flowing at capacity. Two manholes will be threatened with overflow and surcharges elsewhere will be increased. Figure VIII-i also demonstrates the level of surcharge in the wet well which will first threaten the 18-inch Beaver Run interceptor manholes with overflow.

Pump Station Flows

Normal average daily flows at the pump station are about 1,700 gpm. Wet periods increase the daily flow averages to approximately 2,000 gpm. Daily fluctuations are as much as 1,000 gpm night to day time. The highest flows are recorded on Saturdays and Sundays believed due to heavier use from residential homes (bed room communities) and the heavier use of the Kearsarge Mall system. Similar increases in volume are noted in both the Summit flows and the Millcreek flows totaling close to 300 gpm. The



App. 256

Figure VIII-h

KEARSARGE PUMP STATION:
WET WELL & SEWER PIPE/MANHOLE VOLUME

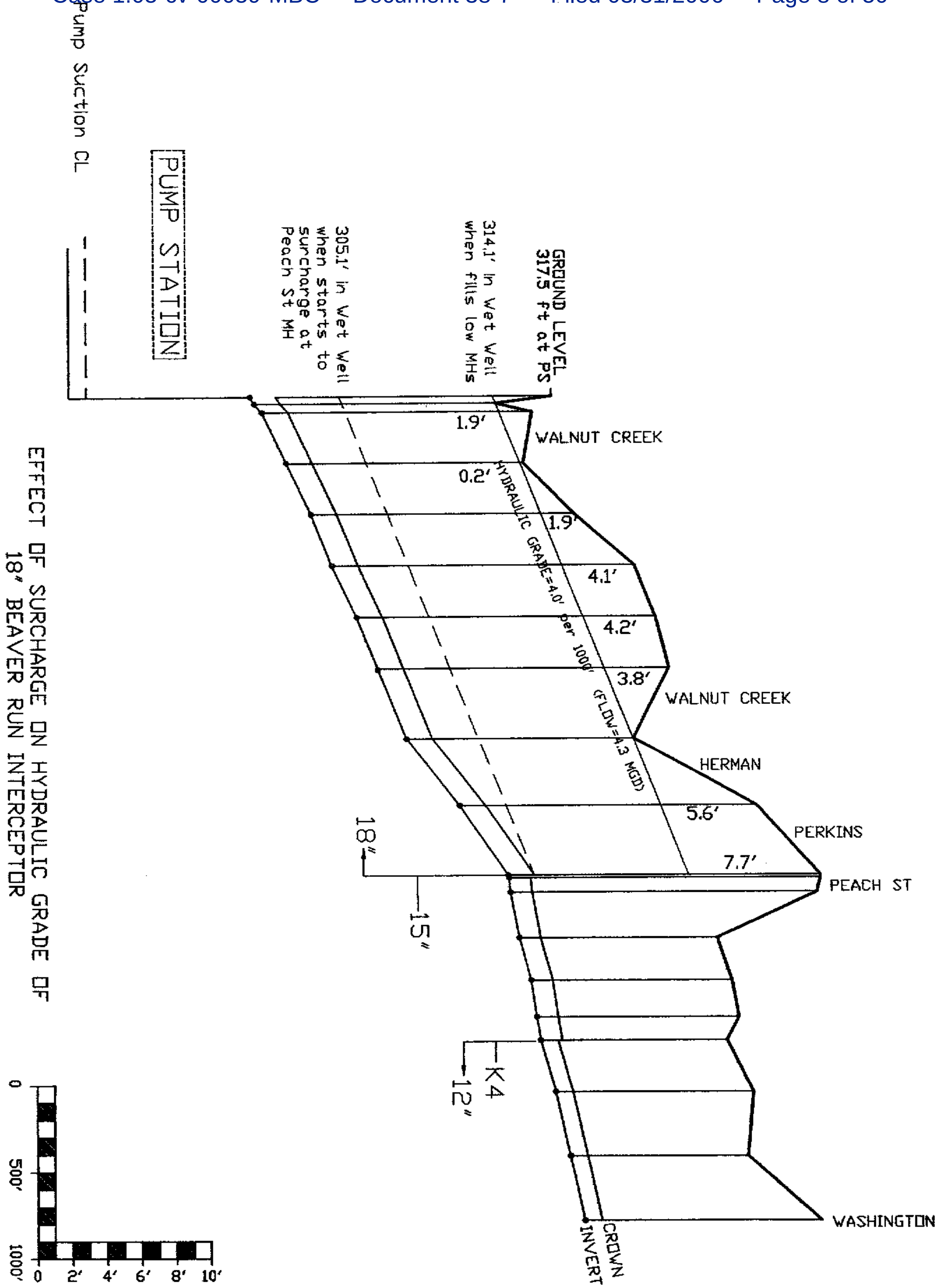
	Elev. (ft)	Wet Well Volume (gal)	Sewer Pipe Add'l Vol (gal)	Total Volume (gal)	% of Total Vol	
Wet Well Floor	289.5	0		0	0	
Pump Suction CL	290.5	317.9		317.9	0.2%	
Top of Fillet	295.0	3979.0		3979.0	2.6%	
	295.5	4837.8		4837.8	3.1%	
Bottom of Barminutor	298.5	9593.5		9593.5	6.2%	
Top of Beam	299.0	10102.8		10102.8	6.5%	
Invert of Intake Pipes	300.0	11404.4	0	11404.4	7.4%	
1st Landing	302.5	14397.6	9820	24217.5	15.6%	
1st Ldg + 1 step	303.125	15449.8	13671	29121.0	18.8%	
1st Ldg + 2 steps	303.75	16523.2	17363	33886.4	21.9%	
1st Ldg + 3 steps	304.375	17596.6	20816	38412.5	24.8%	
1st Ldg + 4 steps	305.0	18670.1	24559	43228.9	27.9%	
2nd Landing	305.625	19743.5	28328	48071.5	31.1%	
2nd Ldg + 1 step	306.25	20817.0	31581	52398.1	33.9%	
Open Bypass	306.5	21246.4	32882	54128.7	35.0%	
2nd Ldg + 2 steps	307.125	22319.8	35851	58170.4	37.6%	
2nd Ldg + 3 steps	307.5	22963.9	37632	60595.5	39.2%	
2nd Ldg + 4 steps	308.125	24037.3	*42444*	66481.8	43.0%	
2nd Ldg + 5 steps	308.75	25110.8	*47257*	72368.1	46.8%	
3rd Landing	309.375	26184.2	*52070*	78254.3	50.6%	
3rd Ldg + 1 step	310.0	27257.7	*56883*	84140.6	54.4%	*1st Basement*
3rd Ldg + 2 steps	310.625	28331.1	*61696*	90026.9	58.2%	
3rd Ldg + 3 steps	311.25	29404.5	*66509*	95913.2	62.0%	
3rd Ldg + 4 steps	311.875	30478.0	*71321*	101799.5	65.8%	
3rd Ldg + 5 steps	312.5	31551.4	*76134*	107685.7	69.6%	
3rd Ldg + 6 steps	313.125	32624.9	*80947*	113572.0	73.4%	
3rd Ldg + 7 steps	313.75	33698.3	*85760*	119458.3	77.2%	
	314.1	34299.5	*88455*	122754.6	79.3%	*Surcharge to MH Rim*
3rd Ldg + 8 steps	314.375	34771.8	*90573*	125344.6	81.0%	
3rd Ldg + 9 steps	315.0	35845.2	*95386*	131230.9	84.8%	
3rd Ldg + 10 steps	315.625	36918.7	*100198*	137117.2	88.6%	
3rd Ldg + 11 steps	316.25	37992.1	*105011*	143003.4	92.4%	
3rd Ldg + 12 steps	316.875	39065.6	*109824*	148889.7	96.2%	
Ground Level at Pump Station	317.5	40139.0	114637	154776.0	100.0%	

NOTE: ***Assumes that barminutor area is solid block (no volume)***
Neglects the volume of the stairs and handrails.
Manholes are assumed to be 4' diameter cylinders.

FIGURE VIII-I

App. 257

MSA-MT 2210



EFFECT OF SURCHARGE ON HYDRAULIC GRADE OF 18" BEAVER RUN INTERCEPTOR

FIGURE VIII-j

MSA-MT 2211

contributions increase even more on the major shopping days (Black Friday, Christmas Eve day, etc.). Thus, a rain event on those days will have a grater impact than on a weekday. As an example, a rain event of only 0.15 inches/hour intensity (0.95 inches/24-hour) resulted in a brief (7 minute) overflow on November 28, 2003 (Black Friday).

The Kearsarge pump station flows are significantly impacted by precipitation and climatic conditions. Flows vary from normal highs of 2,500 gpm (3.6 MGD) during normal weather conditions to normal highs of 3,500 gpm (5.0 MGD) during wet weather. The impact of precipitation at Kearsarge is complicated. As will be shown, the most severe impacts occur in seasons of wet months (December through April) when soils are normally saturated or frozen. Even overflows that have occurred outside that period have been associated with unseasonably wet periods (Table S-2 / VIII-7 / X-3).

There have been twelve overflow events since November, 1992 (11+ years). Three of those have occurred since August of 2003 when this study was initiated. Of the events monitored, only one was associated with a rain fall event with any significant recurrence interval using NOAA "Precipitation Frequency Curves" (NOAA curves were just revised for Pennsylvania and other Ohio River Valley states in May of 2004). NOAA storm frequency predictions for Erie is summarized in Table VIII-8 giving the previous numbers and the more recent numbers. Where differences exist the more recent numbers have been substituted.

Data collected prior to September, 2003, for overflow events is not reliable for quantification analysis. Pump station discharge rates are not accurate, charts could not contain all the information, and pump rates from manholes could not be confirmed. Flows obtained from the later overflow events have therefore been used to predict future events. This was accomplished by constructing a base flow hydrograph describing the station's reaction to the observed storms. To that was added hydrographs of station reactions to larger storms in dry weather when the flows were contained within the station's capacity and were not contaminated by saturated soils.

None of the post August 2003 storms were extreme. The largest storm was 0.9 inches in three hours which created no overflow/bypass. The storms creating overflows include: on September 29, 2003, a 1.10 inch rainfall with a duration of 12 hours and intensities of 0.33 inches/hour and 0.76 inches/180 minutes; on November 30, 2003 (7 minute overflow), a 1.3 inch rainfall over 36 hours with maximum intensities of 0.15 inches/hour and 0.4 inches/120 minutes; and on March 20, 2004, a 0.5 inch rainfall over 11 hours with maximum intensities of .24 inches/hour and 0.28 inches/120 minutes. NOAA (old records) gives the one-year frequency rainfall events as follows: 1 hr. – 0.9 inches; 3 hrs. – 1.25 inches; 6 hrs. – 1.5 inches; 12 hrs. – 1.7 inches; and 24 hrs. – 2.1 inches. September is the closest to an annual event in that 1.1 inches fell in 12 hrs. It also was preceded 36 hours earlier by a similar storm (1.38 inches in 11 hours) and light rain in the intervening time. It can be assumed that the soil was saturated for both the September and March events (at the beginning of the March rain event there were approximately 3 to 6 inches of snow remaining on the ground which would have caused saturated soils and an additional 0.25 to 0.5 inches of water). These two overflow events were then used to structure a base overflow event hydrograph.

TABLE S-2 / VIII-7 / X-3
OVERFLOW DAY'S PRECIPITATION
(inches)

Date	60 Min.	120 Min.	180 Min.	24 Hr.	Previous 2 Weeks	
12/30/92				1.20	0.73	Temp 45° **
9/17/96	0.72	0.86	0.92	3.67	4.40	
2/27/97	0.31	0.53	0.75	1.47	0.93	Thunderstorms - Rain
1/08/98	0.13	0.20	0.23	0.45	*2.08	Rain (some snow)
12/14/99	0.34	0.61	0.75	0.94	1.06	
8/23/00	1.03	1.93	1.95	3.14	2.24	Thunderstorms
11/7/00	0	0	0	0	1.67	No Comments
2/01/02	0.30	0.53	0.81	1.19	2.33	
4/14/02	0.54	0.73	0.78	0.88	2.43	
9/29/03	0.33	0.62	0.76	1.10	4.02	
11/28/03	0.15	0.29	0.40	0.95	1.02	Rain, snow
*** 3/20/04	0.26	0.29	0.29	0.46	0.59	Thunderstorms

* Previous week
** Above freezing previous 2 days & below freezing prior 5 days
*** From City meters (NOAA unedited total = .41 inches

overflowday'sprecipitation(inches)kearsargeps.xl

MSA-MT 2213

TABLE VIII-8

NOAA PRECIPITATION FREQUENCY COMPARISONS
ERIE, PENNSYLVANIA
PRE MAY 2004 VS. POST MAY 2004

Return Period	60 Minutes		120 Minutes		3 Hours		24 Hours	
	Pre	Post	Pre	Post	Pre	Post	Pre	Post
1 yr.	0.90	-	1.05	-	1.22	-	2.10	-
2 yr.	-	1.18	-	1.32	-	1.42	-	2.43
5 yr.	1.45	1.48	1.70	1.68	1.75	1.83	3.00	3.06
10 yr.	1.65	1.72	2.00	2.01	2.10	2.17	3.50	3.63
25 yr.	1.90	2.05	2.25	2.50	2.50	2.72	4.00	4.53
50 yr.	2.10	2.33	2.60	2.92	2.75	3.20	4.50	5.31
100 yr.	2.30	2.62	2.80	3.41	3.10	3.75	4.70	6.23

tableviii-8noaaprecipitationfrequencycomparisons.xl

The data was then researched to determine the impact of storms less frequent in occurrence. Ten years were examined. Three storm frequencies were chosen 1-year, 50-year, and a 5-year, 24-hour event. Ten 1-year or near 1-year events were chosen. Only one 50-year event was available. The third event was chosen because it involved an overflow.

The ten 1-year events are described on Table S-1 /VIII-9 / X-1.

The 50-year frequency storm using NOAA's newest curves (25-year frequency using CTE's storm frequency curves) occurred on September 15, 2002. That storm was proceeded by over a month of dry weather and one day of rain. It caused area wide flooding. Unlike more recent events, it was not in conjunction with saturated soils. There was no overflow. The event is described in the hydrograph on Figure S-a / VIII-k / X-c.

Since the metering available had not yet been adjusted, the meter was reading high and the chart did not record flows above 5,000 gpm (3,750 gpm). We can tell from the chart that the flows exiting the station peaked at values above that level for no more than a two-hour duration, the actual duration of the storm. Maintenance personnel did not report an overflow for that period which enables one to estimate the maximum discharge rate from existing pump performance. The impact of a 50-year storm uninfluenced by infiltration can then be estimated by the area under the curve. Flow rates are estimated to have reached 3,600 gpm to 3,800 gpm based on recent pump performance. The storm flow at the station prior to the storm is estimated at 1,350 gpm. Thus, flow rates are estimated to have increased by 2,250 to 2,450 gpm during this 50-year storm.

The five-year 24-hour storm event was associated with an overflow event and occurred on August 2 and 3, 2000 (Figure VIII-l / X-d). Again, the assessment of this event is hampered by the meter calibration and the chart scale. The event was a combination of three 1-year storms. This event consisted of a 0.97 inch (one year) 60-minute event at noon. This early event caused the typical reaction at the pump station for similar events with an increase of flow of 2,000 gpm (after a 1-1/2 hour delay) with a duration of two hours. Four hours later, after flows had just returned to normal, a second rainfall event began. This event, which spanned four hours, included a 7-year occurrence frequency rainfall intensity over two hours (1.93") and caused the flow rate to jump almost 3,500 gpm to an estimated 5,000 gpm (corrected flow). The storm is not believed to represent a scenario that has any potential to be imposed on a wet weather overflow event since there is no evidence of a 1-year event having occurred in such a situation. It is highly improbable that three such events could occur in a single day under wet conditions.

The September 29, 2003 overflow event demonstrates the impact of saturated soils on pump station flows. Two days prior to the event there was a precipitation event with a significantly higher intensity (60 minutes: 0.55 inches vs. 0.33 inches and 120 minutes: 0.89 inches vs. 0.62 inches) and no overflow occurred or was threatened. In the earlier event flows peaked at 3,100 gpm well below the station's capacity of 3,600 gpm.

TABLE S-1 / VIII-9 / X-1
KEARSARGE PUMP STATION
STORM EVENT IMPACT

Date	Flow Increase (GPM)	Adjusted Flow (GPM)	Duration Hrs.	Duration Avg Q Adj.	Volume
1-Yr. Frequency (0.9 inch/hour)					
7/30/99	1,000				
10/13/1999	1,500	1,170	6.00	546	196,000
5/18/00	2,000	1,560	3.00	1092	196,000
8/26/01	2,000	1,560	2.75	858	141,000
8/19/01	3,000	2,340	1.00	2340	140,000
8/31/01	2,200	1,700	2.00	1014	121,000
6/5/02	2,500	1,950	4.00	1170	280,000
9/14/02	2,000	1,560	4.00	546	131,000
9/27/02	3,000	2,340	4.00	546	131,000
6/21/01	2,000	1,560	-		6/21/2001
Unknown Frequency (0.35 inch/hour)					
5/18/00	800	624			
2/27/00	600	468			
9/14/02	700	550			

Note: Flow increase estimate (1-yr. vs. 0.35)
2000 - 400 = 1,600 GPM

Storage needs assumed to equal 200,000 gallons. The high figure was dropped but no adjustment was made for a .35 inch storm's storage needs.

kearsargepsstormeventimpact.xl

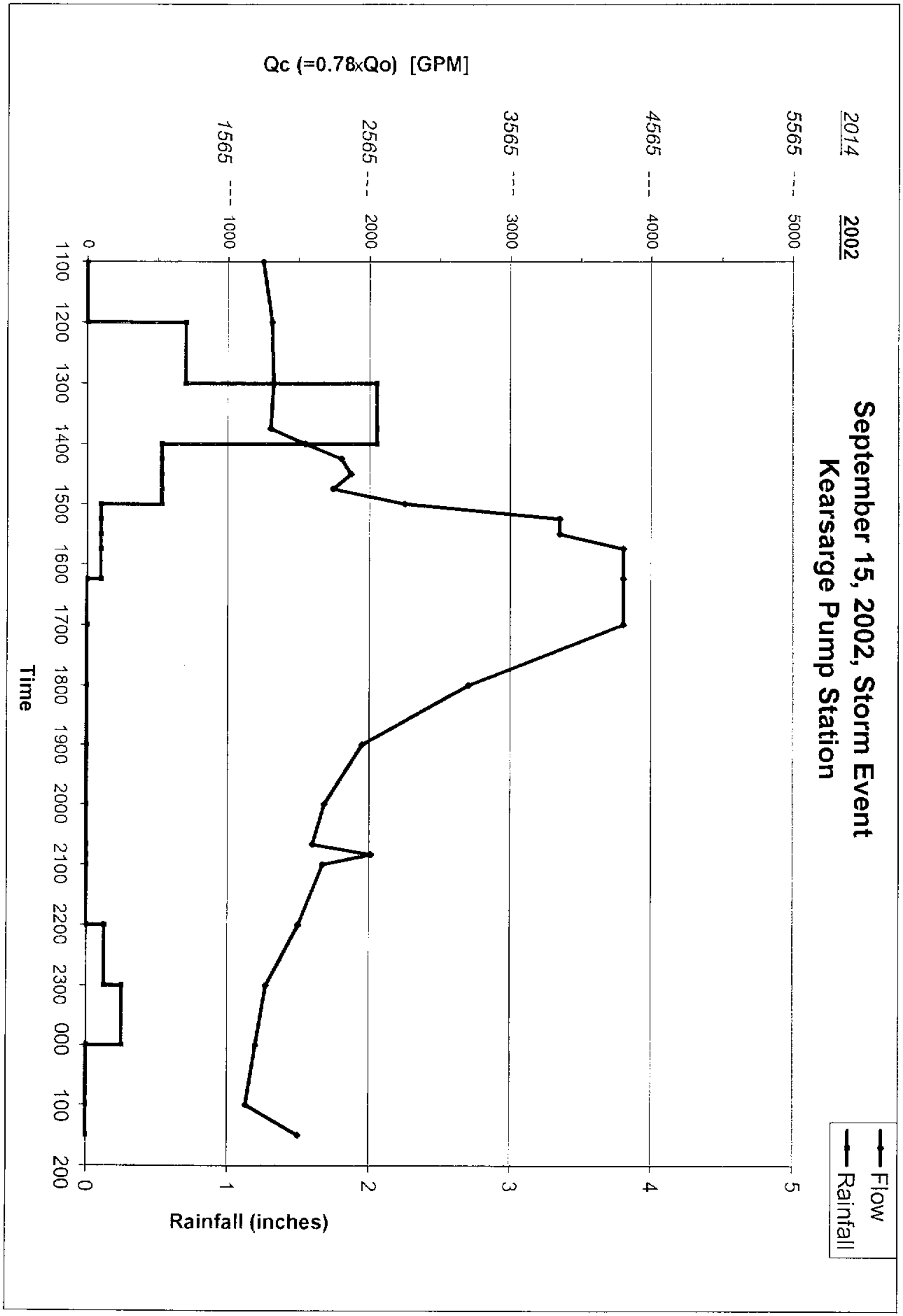


Figure S-a / VIII-k / X-c

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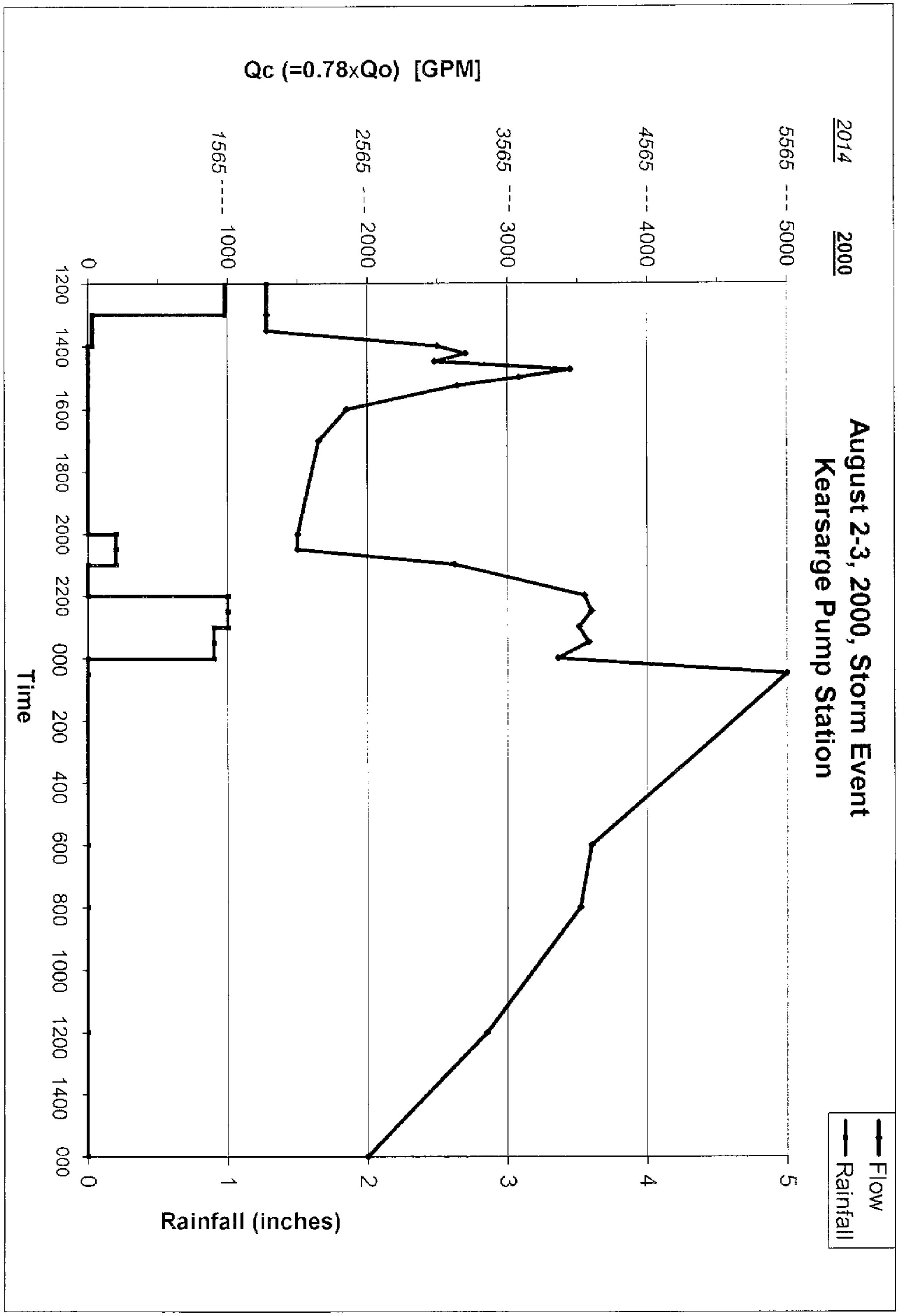


Figure VIII-1 / X-d

MSA-MT 2218

IX. FUTURE GROWTH

A. Introduction

The Kearsarge pump station receives flows from both Summit Township and Millcreek Township.

Summit Township has significant amounts of land still available for development and thus their growth will primarily be limited by demand. Growth includes both commercial and residential development. Of the two, commercial is the least predictable since it depends on economic conditions, competition, and even taxes. The type of development dictates flow characteristics varying from restaurants and hotels which produce the greatest flows per square foot of space to commercial stores which produce the least. The percent of land dedicated to parking also effects flows since it limits the percent of land dedicated to commercial activities.

Residential growth depends primarily on the desirability of an area for social development (schools, recreation, esthetics, access, etc.). Most projections where land is not limiting depend on local agencies' population projections (in this case the Erie County Planning Department), which depend heavily on past trends and do not predict commercial growth. Similarly most unit flow predictions only predict for the commercial and institutional needs of the residents and not outside interest.

Millcreek Township's growth potential is limited by land availability in the area tributary to the Kearsarge pump station. There is only about 200 acres of available land for development. To this must be added lands or developable lots remaining unpopulated plus homes presently not served by sewers which are in need. The vacant undeveloped land in Millcreek includes the following land use: single family, multi-family, commercial, industrial, rural, residential, and parks and recreation (see Appendix B-1).

In this treatise an EDU was assumed to equal three persons and a flow of 70 gpd per person. To compare, the tapping fee regulations require the use of the number of persons per household determined by the census and 90 gallons/capita. In Millcreek this is 2.42/household equaling 217 gpd vs. 210 gpd (Summit's household size is higher at 2.63 per household).

Summit Township:

Summit Township Sewer Authority has elected to settle on use of the historical (past ten years) increase in sewer EDU's added to the sewer system as a means of estimating their ten-year growth. The attached letter in Appendix A-2 shows their concurrence with the use of 88 units per year at 1 EDU/unit (Summit may assign more than one unit to a proposed use depending on its potential to produce wastes i.e. restaurants). They also have elected to limit their ultimate flow contribution to that committed to the City or 3.9 MGD as evidenced by the same letter in Appendix A-2. They will limit that flow by providing equalization if necessary. The 10-year peak flow increment 2.5 x EDU is

estimated at 462,000 gpd and the ultimate peak flow increment after ten years equals 1.142 MGD. This flow is summarized in Table S-3 / IX-1 / X-2 attached here as well as in the Summary section.

Millcreek Township:

The Millcreek Township flow projections are based on an assumed density of development on vacant land and an assumption that all other building lots will be occupied and that homes now served by septic tanks will be connected to sewers.

This is in conformance with all plans and regulations presented in Chapter V including the Millcreek Land Use Plan except for area D (a five-acre parcel with 15 EDU's). This parcel is privately owned but zoned recreational and parks. This study does not referee between property rights and prefers to error on the conservative side.

Figure IX-a is an aerial photograph on which the area of Millcreek Township tributary to the Kearsarge pump station had been outlined. The parcels of land not yet being developed are also shown on the photograph. Table IX-2 lists those areas not developed along with their acreage and estimated flow potential. All lands were estimated to develop at 3 EDU's per acre which is relatively dense. However, a lot of the land is expected to develop with apartments or commercial uses (restaurants) and the high density is believed justified. Five areas are shown with the largest located south of the station. Flows averaging 44,000 gpd (peak 0.11 MGD) are estimated over the next ten years and an additional 77,000 gpd (peak 0.192 MGD) is predicted to reach ultimate.

A study completed by Millcreek Township Sewer Authority found many existing homes with malfunctioning septic systems (Appendix B-2). These and the lots remaining to be developed are to be serviced by sewers are also detailed on Table IX-2. There are 116 of these equaling a flow of 24,000 gpd and a peak of 60,000 gpd. Total Millcreek projected growth flows are also summarized on Table S-3 / IX-1 / X-2 and equal 0.17 MGD (120 gpm) in ten years and an additional 0.192 MGD (133 gpm) ultimate.

County Projections:

The Erie County projections for Summit and Millcreek Townships are given in their publication "Erie County Demographic Study" of January 2003. They project growth for the individual municipalities by a "Current Trend" scenario. They project Millcreek's growth at 1,853 persons over the next ten years and Summit's at 125.

The publication also sets a high scenario but only projects population for the county in this scenario. If the ratio of high scenario to current trend scenario for the county is determined, it can be applied to the individual municipalities. This ratio is 9308/5201 or 1.79. That number times the current trend numbers for Millcreek and Summit equal 3317 and 224 respectively (332/yr. and 22.4/yr.).

TABLE S-3 / IX-1 / X-2
MAXIMUM FLOW ESTIMATE
KEARSARGE PUMP STATION

Source	10-Year Flow Increase MGD	GPM	Ultimate Flow Increase MGD	GPM
Existing Flows		[1] 4,800		5,240
Millcreek Flows [2]	0.17	120	0.192	133
Summit Flows [2]	0.462	320	1.142	800
Sub-Total		5,240		6,173
Contingency Flows [3] (1-Yr. Frequency)		1,600		1,600
		6,840		7,773
Contingency Flows [4] (20 to 100-Yr. Frequency)		2,300		2,300
		7,540		8,473

1. Based on 9/29/03 storm
2. See Chapter X
3. See Table S-1
4. Based on 9/15/02 storm

maximumflowestimatetablekearsargeps.xl

TABLE 1X-2

MILLCREEK GROWTH
(EDU = 3 PERSONS X 70 GALLONS)

Area Vacant Land	Description	Acreage	Homes (EDU)	Avg. Flow MGD 0-10	Avg. Flow MGD Ultimate
A	Kuntz Road	106	318	0.000	0.067
B	Btw Edinboro Rd & I-79	34	105	0.022	
C	South of Grandview	31	93	0.020	
D	West of I-79	16	48		0.010
E	East of I-79, North of Zimmerly	5	15	0.003	
	Total	192	576	0.044	0.077
	x 2.5			0.110	0.192
Millcreek Existing Subdivisions	Eagle & Glen Eagle		58		
	Rinderle & Moraine		16		
	Goedecker		10		
	Springhill		32		
			116	0.024	
	x 2.5			0.060	
Total				0.170	0.192

table1x-2millcreekgrowth.xl

Figure IX-a

MSA-MT 2223

In Millcreek there are three areas seeing significant development southeast, south central, and southwest (another ¼ of development is projected throughout the township). If ¼ of the growth is expected in each of the three areas, between 463 and 829 persons would expect to reside in the Kearsarge area. Of the 329 EDU's predicted for Kearsarge in ten years, 105 are expected to be commercial, leaving 224 residential. Using the county's residents/household, that equals 542 persons which lies comfortably between the two estimates.

In Summit approximately 50% of their EDU's are commercial. If this trend continues, 44 of the annual EDU increase expected by Summit is expected to be residential. Since no figure is given for persons/household for Summit in the 2000 Census table in the county study, the 1990 Census figure was adjusted using the county change (1990 to 2000) and equals 2.63.

If the entire 22.4 persons projected by the county study were to construct in the Route 19 corridor, this equals 8.5 EDU's which leaves up to 35 EDU's available to service existing homes presently on septics. The Summit's "Sewage Disposal Needs Survey" estimated 283 residences needing service in the Kearsarge service area. If this were accomplished over the next ten years, that equals 28 EDU's per year. Thus, it is concluded that the Summit project agrees well with the county's with a reserve of 8 per year.

Act 537 Sewage Facilities Plan Millcreek Township Sewer Authority December 2003 Draft

The Millcreek Township's Act 537 Plan Update Draft of 12/12/03, using the PA DEP projections, projects Millcreek's ten-year growth at approximately 3,200 persons which is very close to that found in the County Study for their high scenario. The township's Act 537 Study predicts Summit's growth at 174 persons in that same period which lies between the county's "Current Trend" and "High" scenarios. Our comment, therefore, remains the same, that Millcreek's projection appears reasonable while Summit's is conservative.

X. ALTERNATES AVAILABLE TO UPGRADE, IMPROVE AND/OR EXPAND THE KEARSARGE PUMP STATION

A. Alternates

Introduction

The study is a "Special Study" of the Kearsarge pump station and its tributary interceptors. It does not investigate other alternatives (such as onlot disposal) to the continued use of this facility modified to eliminate overflows. It is part of a regional wastewater treatment facility and all recommendations are to allow for extension of its tributary sewer network into need areas in its defined service area.

The report investigates the pump station and its tributary interceptors' present condition and recommends alternative fixes to the station and its tributary sewers to resolve deficiencies uncovered. The emphasis is to provide sufficient capabilities at the station and its tributary sewer system to address wet weather and storm events now and in the future. The study addresses ten-year and ultimate flows.

Three alternatives were originally selected for study and were specifically outlined in the Consent Agreement. They were: booster pumps, pump station replacement; and storage. The Consent Order further limited the alternate selection process to not consider impacts from Infiltration/Inflow Abatement.

Pump station replacement/modification and booster stations have been studied in past studies but have been abandoned in this case. The use of these alternates would have increased the forward flow by as much as 4,000 gpm (5.7 MGD) depending on the alternative flow selected. MTSA and Erie City are presently negotiating over exceedances of Millcreek's agreed to peak flows entering the City at Manor Drive which is the connection point used by the Kearsarge station. Thus, it has been concluded that the pumped forward flow rates should be minimized and limited to those which can be incorporated into the existing station without major structural modifications.

First, the pump station was investigated to determine operational problems and expansion capabilities. Upgrade recommendations were made.

Second, design flow alternatives were developed using station flow data related to storm events. The trick is to determine what precipitation induced flow rates and volumes can be reasonably expected to be experienced at the station beyond those which have already been experienced. The study used observed station responses to storms, idiosyncrasies of those experiences, and NOAA storm recurrence frequency predictions to assess the potential for merging of events to produce an as yet unobserved condition. The base flow is an observed event and the merged events are referred to as contingency flows. The data on merged events were obtained during dry periods when there was no contamination of the values due to wet conditions or saturated soils. They were then merged flow results during a wet condition which had involved an overflow (base storm).

Finally, flows tributary to the pump station from three interceptors were determined to define the flow percentages from each direction. Contingency flows were then added to the base flow from each interceptor in the same percentages. Future flows from development were then added to each.

Pump Station Upgrade

The pump station's last major upgrade was in 1984. The evaluation indicates the following upgrades are needed regardless of the expansion alternates selected.

- New variable frequency drives (Bid Date 5/20/04)

- New controller (Bid Date 5/20/04)
- Replace pump #3 with pump identical to pumps #1 and #2 as a standby (10 State Standards)
- Provide automatic transfer switch for power protection
- Replace the generator with a larger unit
- SCADA
- Odor control
- Rain gauge

Flow Rate & Volumes

The Kearsarge pump station is subjected to high flows during two different environmental conditions. The first is small rainfall events (< 1 year frequency) with saturated soils when it is believed runoff runs toward foundation drains which are tributary to the sanitary system. The second is inflow from high intensity storms. The two scenarios have not coexisted in the ten years of data reviewed for this study. In fact, only two rainfall incidents have been documented to have hourly intensities higher than 0.35 inch/hour during the colder months with normally saturated soils (December through April). They were .5 and .75 inches. However, there have been incidents of saturated soils outside that period where higher intensity storms commonly exist. Similarly though extreme storm events (low occurrence frequency) are not common in these periods.

The major storm to protect against becomes the storm with the least frequent occurrence which can be expected to occur during the period of December through April or other soil saturated times. Such an approach should provide capacity to manage the higher intensity less frequent storms during the dryer hotter periods.

There are many options available to the Authority depending on the storm contingency desired. The lesser the frequency storm assumed in conjunction with a wet saturated small storm event, the more secure the design. No matter what the decision, it must be remembered that no design will guarantee that the design criteria will not be exceeded by some yet unexperienced event.

The storm events studied are found graphed in Figures X-a, X-b, S-1/VIII-9/X-c and VIII-j/X-d. The procedure used to predict future flows was to use the most recent overflow events where good data is available to establish a base flow for saturated soils with a known rainfall intensity (in this case 0.35 inch/hour on September 29, 2003) as a base. The actual flow values were cross-checked with the values obtained for the March 20, 2004 storm.

Other storms whose uncontaminated impact on the Kearsarge flows could be determined were then superimposed on the base storm. Three storm frequency events were used. They were selected to meet three qualitative conditions for coexisting with the base storm: probable, improbable, and highly improbable.

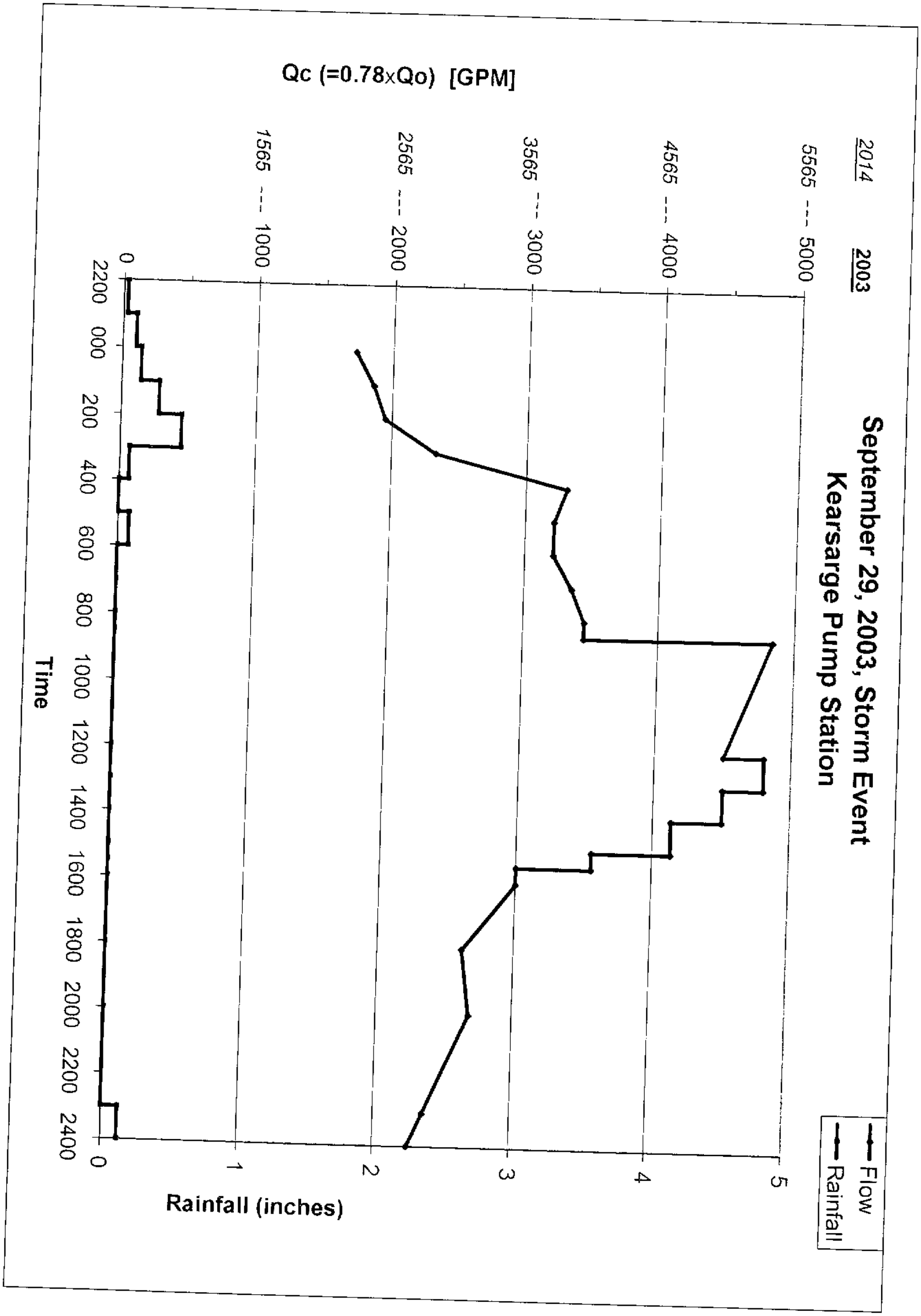


Figure X-a

MSA-MT 2227

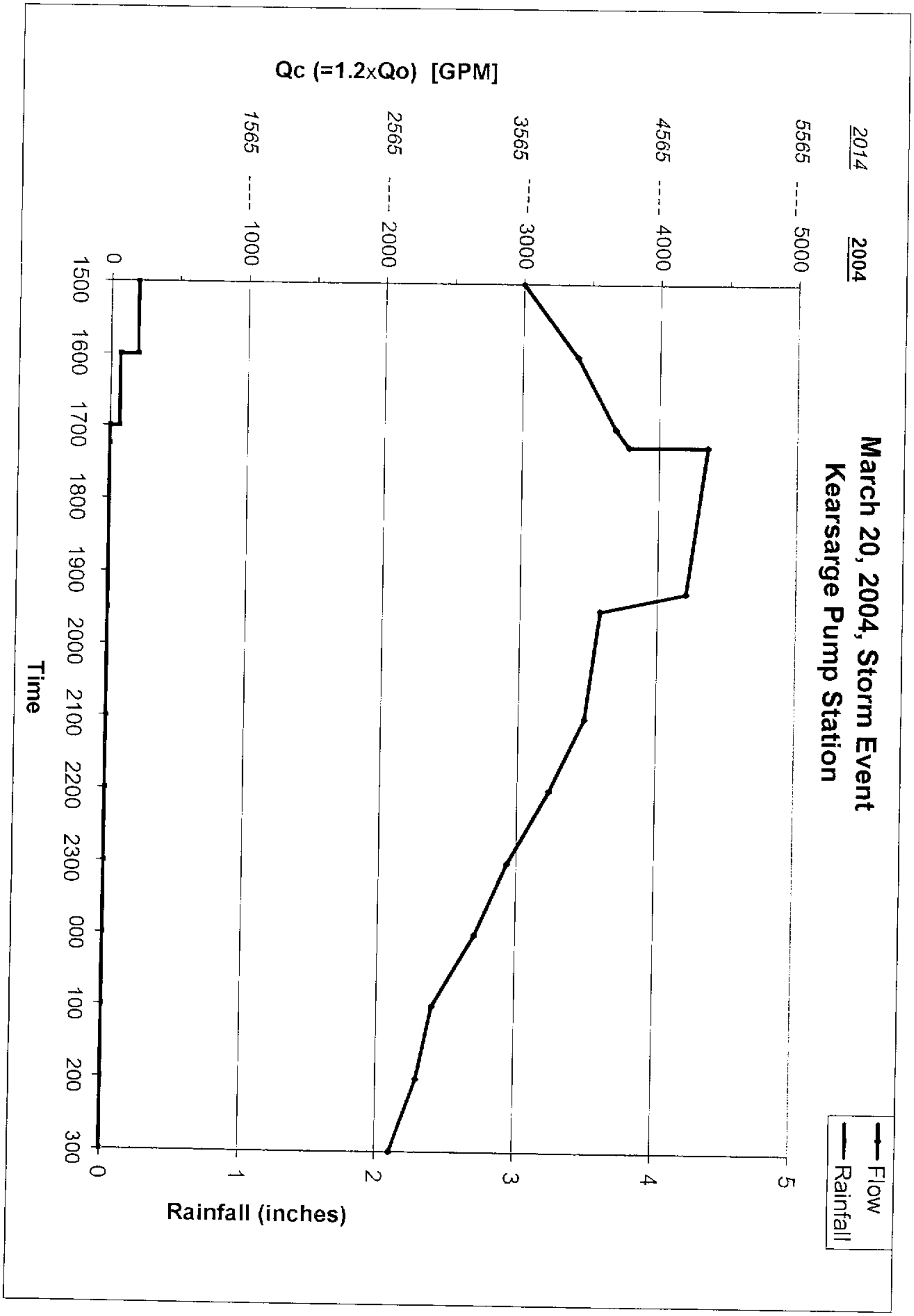


Figure X-b

MSA-MT 2228

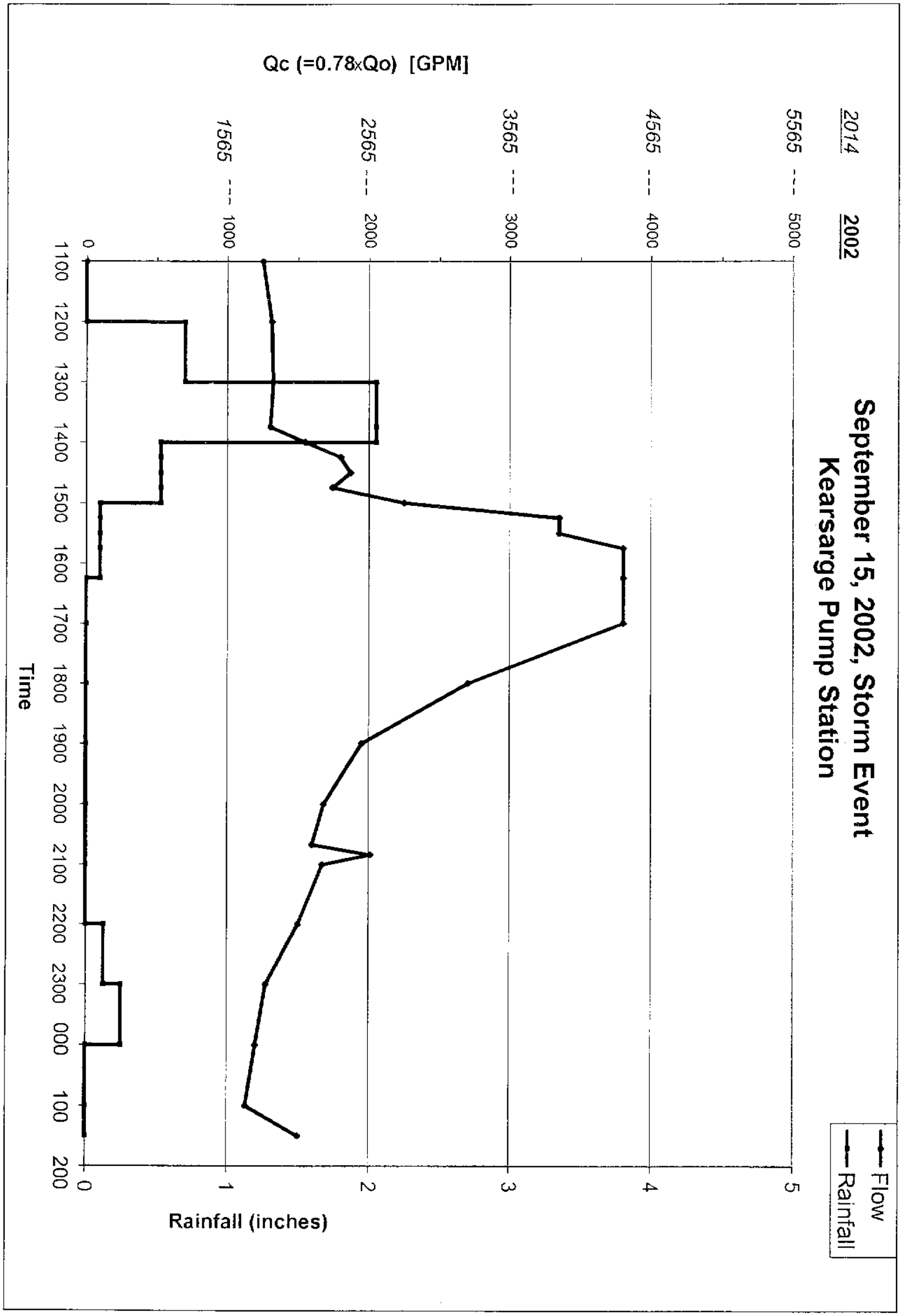


Figure S-a / VIII-i / X-c

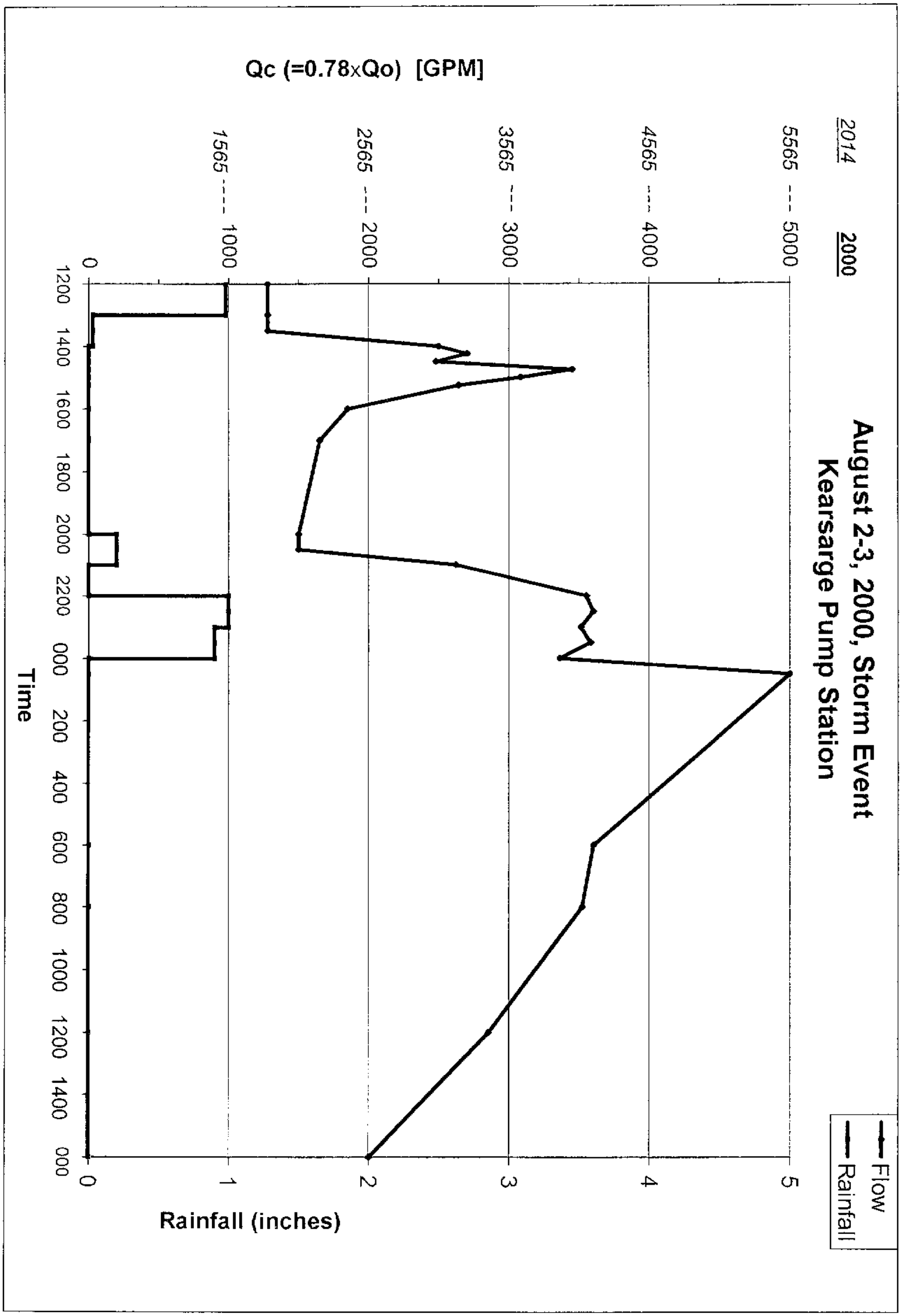


Figure VIII-j / X-d

MSA-MT 2230

The first was based on ten 1-year frequency events, Table S-1/VIII-9/X-1 (the 0.35 inch storm impact was deducted from the 1-inch impact). The second was the 25 to 50-year event recorded on September 15, 2002 (no adjustment was made for the 0.35 inch rainfall). The final event was the 5 to 7-year event on August 2, 2000. However, this last event is not believed to be an uncontaminated event. It is believed the first storm saturated the soils and only the impact of the second storm is germane. This impact is equal to that of a single 1-year frequency flow. It is not used in the design storm selection.

The flow predictions using these storms are found in Table S-d/1X-1/X-2, "Maximum Flow Estimate – Kearsarge Pump Station." The values found for existing flows are from the September, 2003 event. The values for additional flows are the flow rates suggested to account for contingencies to allow for the coexistence of a 1-year storm event and a 50 to 25-year storm event with saturated soil event. A contingency amount is not included for a storm event similar to the August 2, 2000 event since it was considered contaminated.

The 1-year frequency storm is assumed to add 1,600 gpm to station base flows after correcting for 0.35 inch storm intensity impacts (Table S-2/VIII-7/X-3). Thus, if a 1-year storm (≈ 1"/hr.) were to have been experienced during the September 2003 event, it is estimated that peak flows would have been increased by 1,600 gpm and would have reached 6,400 gpm. The 25 to 50-year storm increased flows by 2,300 gpm and would have increased the base flow storm to 7,100 gpm. The final storm, August, 2000, has not been included in the table, but it is estimated that it would have increased flows 3,000 gpm had it begun with saturated soils.

Pump Station Expansion

Three alternates have been proposed. As instructed by the PA DEP, none depend on flow reduction. However, alternates have been limited to the ten-year need to allow for assessment of the abatement efforts underway as well as the accuracy of estimates and assumptions used in this report before providing for the ultimate flows. However, a fourth alternate is provided which addresses the facility sizing needs anticipated in 2014 if flow reduction efforts are not successful.

Tables S-4 / X-4, S-5 /X-5, and S-6 / X-6 give the storage pumping and capacity for three forward flow alternates (3,600 gpm, 4,500 gpm, and 5,500 gpm). The first is existing pumping capacity, the second is compensation for future ten-year growth and requires no structural change, and the third is the maximum accomplishable in the existing station but requires force main reconstruction.

The alternates for pump station expansion to accommodate 2014 flow estimates without and with the two contingency events defined above in order of perceived desirability are:

TABLE S-1 / VIII-9 / X-1
KEARSARGE PUMP STATION
STORM EVENT IMPACT

Date	Flow Increase (GPM)	Adjusted Flow (GPM)	Duration Hrs.	Duration Avg Q Adj.	Volume
1-Yr. Frequency (0.9 inch/hour)					
7/30/99	1,000				
10/13/1999	1,500	1,170	6.00	546	196,000
5/18/00	2,000	1,560	3.00	1092	196,000
8/26/01	2,000	1,560	2.75	858	141,000
8/19/01	3,000	2,340	1.00	2340	140,000
8/31/01	2,200	1,700	2.00	1014	121,000
6/5/02	2,500	1,950	4.00	1170	280,000
9/14/02	2,000	1,560	4.00	546	131,000
9/27/02	3,000	2,340	4.00	546	131,000
6/21/01	2,000	1,560	-		6/21/2001
Unknown Frequency (0.35 inch/hour)					
5/18/00	800	624			
2/27/00	600	468			
9/14/02	700	550			

Note: Flow increase estimate (1-yr. vs. 0.35)
2000 - 400 = 1,600 GPM

Storage needs assumed to equal 200,000 gallons. The high figure was dropped but no adjustment was made for a .35 inch storm's storage needs.

kearsargepsstormeventimpact.xl

TABLE S-3 / IX-1 / X-2
MAXIMUM FLOW ESTIMATE
KEARSARGE PUMP STATION

Source	10-Year Flow Increase MGD	GPM	Ultimate Flow Increase MGD	GPM
Existing Flows		[1] 4,800		5,240
Millcreek Flows [2]	0.17	120	0.192	133
Summit Flows [2]	0.462	320	1.142	800
Sub-Total		5,240		6,173
Contingency Flows [3] (1-Yr. Frequency)		1,600		1,600
		6,840		7,773
Contingency Flows [4] (20 to 100-Yr. Frequency)		2,300		2,300
		7,540		8,473

1. Based on 9/29/03 storm
2. See Chapter X
3. See Table S-1
4. Based on 9/15/02 storm

maximumflowestimatetablekearsargeps.xl

TABLE S-2 / VIII-7 / X-3
OVERFLOW DAY'S PRECIPITATION
(inches)

Date	60 Min.	120 Min.	180 Min.	24 Hr.	Previous 2 Weeks	
12/30/92				1.20	0.73	Temp 45° **
9/17/96	0.72	0.86	0.92	3.67	4.40	
2/27/97	0.31	0.53	0.75	1.47	0.93	Thunderstorms - Rain
1/08/98	0.13	0.20	0.23	0.45	*2.08	Rain (some snow)
12/14/99	0.34	0.61	0.75	0.94	1.06	
8/23/00	1.03	1.93	1.95	3.14	2.24	Thunderstorms
11/7/00	0	0	0	0	1.67	No Comments
2/01/02	0.30	0.53	0.81	1.19	2.33	
4/14/02	0.54	0.73	0.78	0.88	2.43	
9/29/03	0.33	0.62	0.76	1.10	4.02	
11/28/03	0.15	0.29	0.40	0.95	1.02	Rain, snow
*** 3/20/04	0.26	0.29	0.29	0.46	0.59	Thunderstorms

* Previous week
** Above freezing previous 2 days & below freezing prior 5 days
*** From City meters (NOAA unedited total = .41 inches

overflowday'sprecipitation(inches)kearsargeps.xl

TABLE S-4 / X-4

INCREMENTAL PUMPING & STORAGE REQUIREMENTS
STATION PUMPING RATE = 4,500 GPM

STORM EVENT	BASE [1]	1-Yr. [2]	1/2/3/24-Hr. [3] 25 to 50 Yr.	1 Hr./1 Yr. [4] & 2-Hr./10-Yr.
Wet Months				
Δ Storage Rate (gpm)	400 gpm	1,900 gpm	2,700 gpm	3,500 gpm
Δ Storage (2004)	180,000 gal.	380,000 gal.	720,000 gal.	650,000 gal.
Δ Storage Rate (2014)	840 gpm	2,340 gpm	3,140 gpm	3,940 gpm
Δ Storage (2014)	300,000 gal.	500,000 gal.	840,000 gal.	1,638,000 gal.
Dry Months				
Δ Storage Rate	0	0	0	600 gpm
Δ Storage	0	0	0	90,000

Assume Pump Rate at 4,500 gpm

1 September, 2003 rainfall 0.35 inch/hr.
2 Ten Storms (low & high eliminated) Top 2 remaining storms used.
Storms eliminated equaled 280,000 gallon storage and 1,800 gpm.
3 September, 2002 storm
4 August, 2000 storm

incrementalpumping&storagerequirements4500kearsargeps.xl

TABLE S-5 / X-5

INCREMENTAL PUMPING & STORAGE REQUIREMENTS
STATION PUMPING RATE = 5,500 GPM

STORM EVENT	BASE [1]	1-Yr. [2]	1/2/3/24-Hr. [3] 25 to 50 Yr.	1 Hr./1 Yr. [4] 2-Hr./10-Yr. & 24-Hr./5-Yr.
Wet Months				
Δ Storage Rate (gpm)	0 (-700) gpm	800 gpm	1,600 gpm	2,500 gpm
Δ Storage (2004)	0 gal.	110,000 gal.	270,000 gal.	630,000 gal.
Δ Pump Rate (2014)	0 (-260) gpm	1,240 gpm	2,040 gpm	2,940 gpm
Δ Storage (2014)	0 gal.	160,000 gal.	400,000 gal.	882,000 gal.
Dry Months				
Δ Pump Rate	0	0	0	0 gpm
Δ Storage	0	0	0	0

Assume Pump Rate at 5,500 gpm

1 September, 2003 rainfall 0.35 inch/hr.
2 Ten Storms (low & high eliminated) Top 2 remaining storms used.
Storms eliminated equaled 280,000 gallon storage and 1,800 gpm.
3 September, 2002 storm
4 August, 2000 storm

incrementalpumping&storagerequirements5500kearsargeps.xl

MSA-MT 2236

TABLE S-6 / X-6

INCREMENTAL PUMPING & STORAGE REQUIREMENTS
STATION PUMPING RATE = 3,600 GPM

STORM EVENT	BASE [1]	1-Yr. [2]	1/2/3/24-Hr. [3] 25 to 50 Yr.	1 Hr./1 Yr. [4] & 2-Hr./10-Yr.
Wet Months				
Δ Storage Rate (gpm)	1,200 gpm	2,700 gpm	3,500 gpm	4,400 gpm
Δ Storage (2004)	360,000 gal.	520,000 gal.	1,100,000 gal.	3,200,000 gal.
Δ Pump Rate (2014)	1,640 gpm	3,140 gpm	3,940 gpm	4,840 gpm
Δ Storage (2014)	605,000 gal.	765,000 gal.	1,345,000	4,150,000 gal.
Dry Months				
Δ Storage Rate	0	0	800	1,900 gpm
Δ Storage	0	0	72,000	672,000

Assume Pump Rate at 3,600 gpm

1 September, 2003 rainfall 0.35 inch/hr.
2 Ten Storms (low & high eliminated) Top 2 remaining storms used. Storms eliminated equaled 280,000 gallon storage and 1,800 gpm.
3 September, 2002 storm
4 August, 2000 storm

incrementalpumping&storagerequirements3600kearsargeps.xl

A. Expand station forward pumping capacity to 4,500 gpm (an increase of 700 gpm in present peak pumping rates) and provide storage pumping of 840 gpm; 2,340 gpm; or 3,140 gpm and storage of 300,000 gallons; 500,000 gallons; or 840,000 gallons depending on the design contingency storm.

B. Expand station forward pumping capacity to 5,500 gpm (an increase of 1,700 gpm in present peak pumping rates) and provide storage pumping of 0 gpm; 1,240 gpm; or 2,040 gpm and storage of 0 gallon; 160,000 gallons; or 400,000 gallons depending on the design contingency storm. This alternate requires altering up to 1,700 feet of the force main.

C. Leave station forward pumping capacity at 3,600 gpm and provide storage pumping rate of 1,640 gpm; 3,140 gpm; or 3,940 gpm and storage of 605,000; 765,000; or 1,345,000 gallons.

D. Design for ultimate adds 933 gpm to the storage pump rate or to the forward flow and adds 300,000 gallons to the storage needs if not pumped forward.

Finally, the storage pumping rate and storage needed for any of the contingency flow events occurring in dry months is also found in Table S-4 / X-4. It is concluded that any of the alternate facility designs above will provide sufficient forward pumping and storage capacity to address any storm event induced flows during periods of nonsoil saturated conditions through 2014. The 3,600 gpm alternate will need an additional 165 gpm of forward pumping to handle the most extreme event which could be provided by the standby pump or system storage.

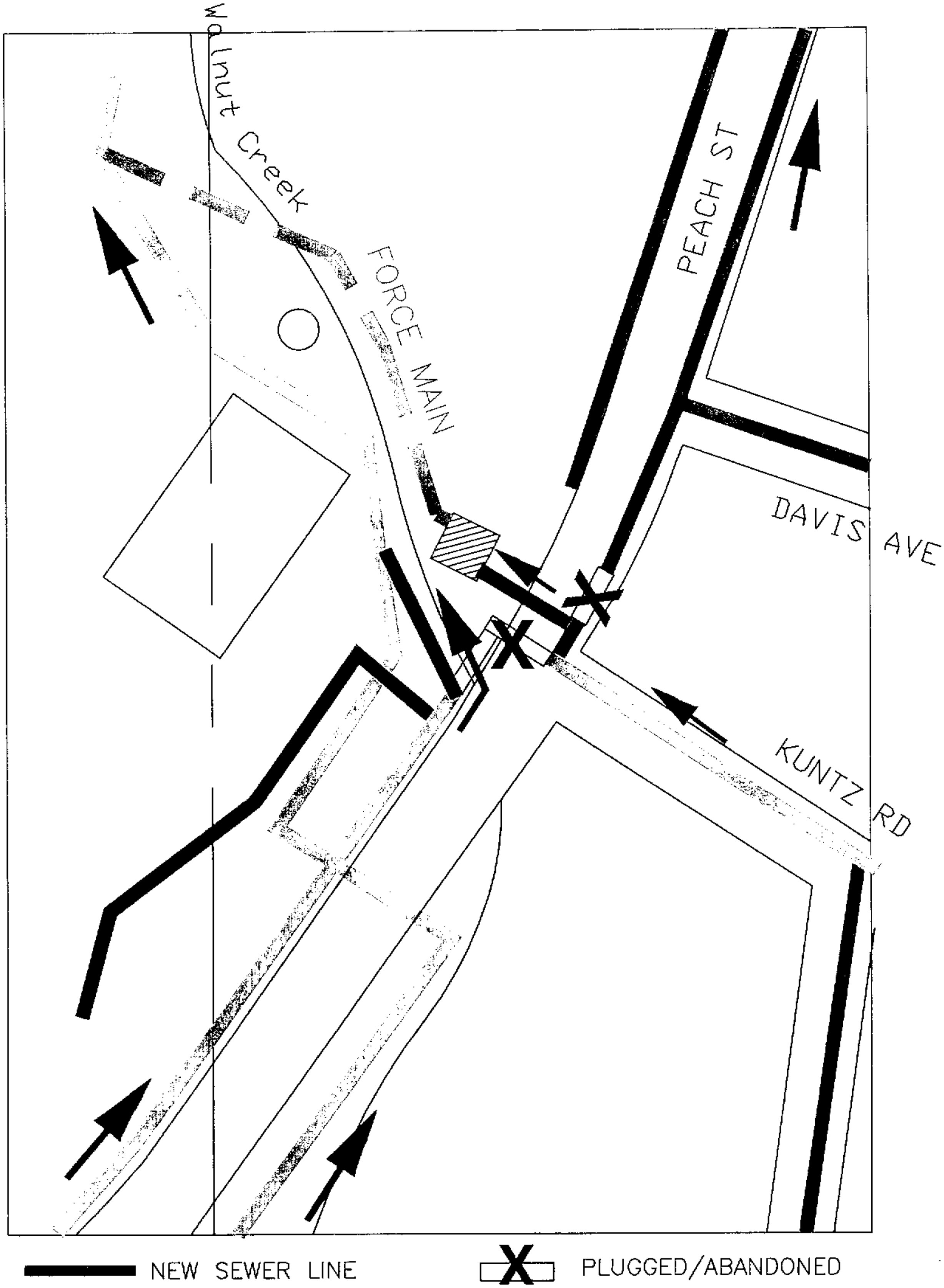
<u>Tributary Sewer Needs (Figure SI-a / VIII-d)</u>

The 24-inch sewer could be used to accommodate flows diverted from the Millcreek southern Peach Street sewer thus reducing flows entering the 18-inch Beaver Run interceptor. The Peach Street sewer south of Walnut Creek carries Summit and Millcreek flows from Interchange and Edinboro Roads and Millcreek flows from Route 19 north to the Summit Township border. It could be diverted to the 24-inch (Figure X-e). Based on its drainage area in Millcreek it could be assumed to contain up to 20% of the flow in the 18-inch sewer. Thus 1.2 MGD could be removed from the ultimate flow (1-year storm event) reducing the Beaver Run flow to 4.6 MGD (300,000 gpd above the sewer capacity). The surcharge created by the flow remaining in the interceptor will not endanger homes or allow overflows if pump station discharges are prevented.

The immediate downstream capacity in the 24-inch from the anticipated connection point is 6.5 MGD. If the Peach Street sewer is diverted, Summit flows plus Millcreek's will equal 5.1 MGD leaving 1.4 MGD capacity remaining without surcharge.

Summit has stated that 1.3 MGD of their future ultimate flow could come from Rt. 99. This would have no impact on the 24-inch mall sewer if the Millcreek Peach Street sewer were diverted to it since it has always been assumed all Summit flows would be placed in the mall sewer. It would have a disastrous effect on the 18-inch Beaver Run sewer if it

FIGURE SI-a/VIII-d



SECTION C: Peach St at Kuntz Rd

FIGURE x-e

were not diverted. This incremental flow was not considered in the surcharge calculation and would have a disastrous effect if it were not diverted. Its potential makes mandatory the diversion of the Peach Street sewer south of Walnut Creek.

A capacity of 5.6 MGD will remain in the 24-inch mall sewer 400 ft. downstream where the slope changes. If it is deemed necessary to divert additional flows, after the results of the I&I abatement are known and after further consideration of the design storm events' effect, the Kuntz Road sewer could also be diverted. This flow is from a tributary area equal to 17% of the Beaver Run interceptor total drainage. Since this area is projected to be very densely populated, 20% of the ultimate flow is estimated to originate here or another 1.2 MGD. This diversion is also described in Figure X-e. The flow will have to be pumped across Walnut Creek and the force main will be required to be connected to the mall sewer below the critical slope length (400± ft.). The effort will reduce the 18-inch flow further to 3.4 MGD which will allow even the 50 to 25-year storm event flows to pass even in conjunction with saturated soils.

The 15-inch relief for Zimmerly is progressing as shown on Figure X-f. The work is temporarily delayed. When finished it will intercept flows from Dixson and 51st Street leaving only the flow from the areas west of the interstate and Zimmerly Road to be transported by the existing 10-inch.

No construction is proposed for the Beaver Run extension.

If Summit flows on Rt. 99 were to reach their full potential of 1.3 MGD, then the sewers on and crossing Interchange Road will need relieved as described on Figure X-g. Rt. 99 flows would be diverted to a new sewer and connected to the Peach Street sewer north of Interchange Road.

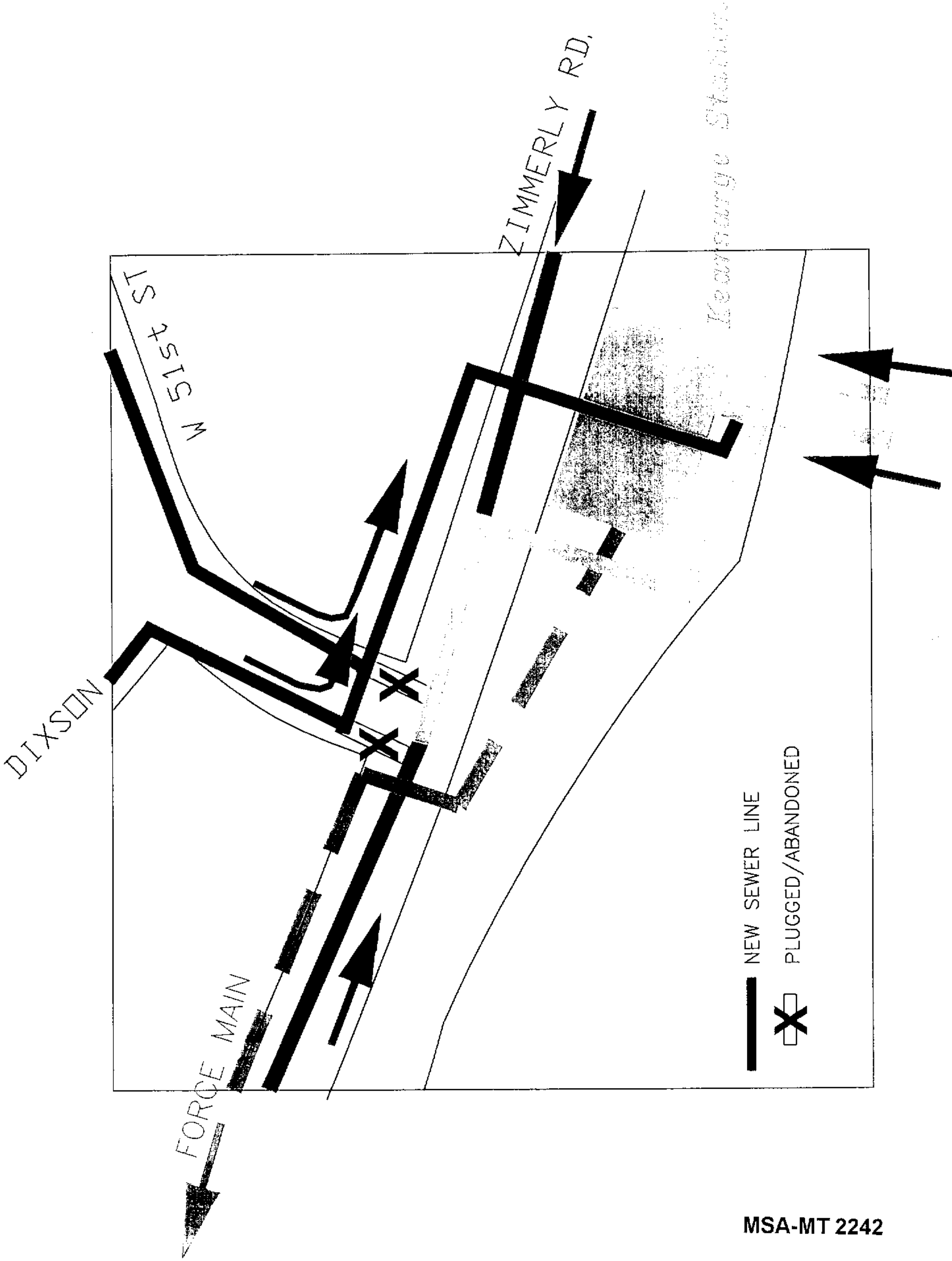
This need will not be apparent for some time, however, since the total flows expected by Summit in the next ten years are only 0.462 MGD.

Miscellaneous

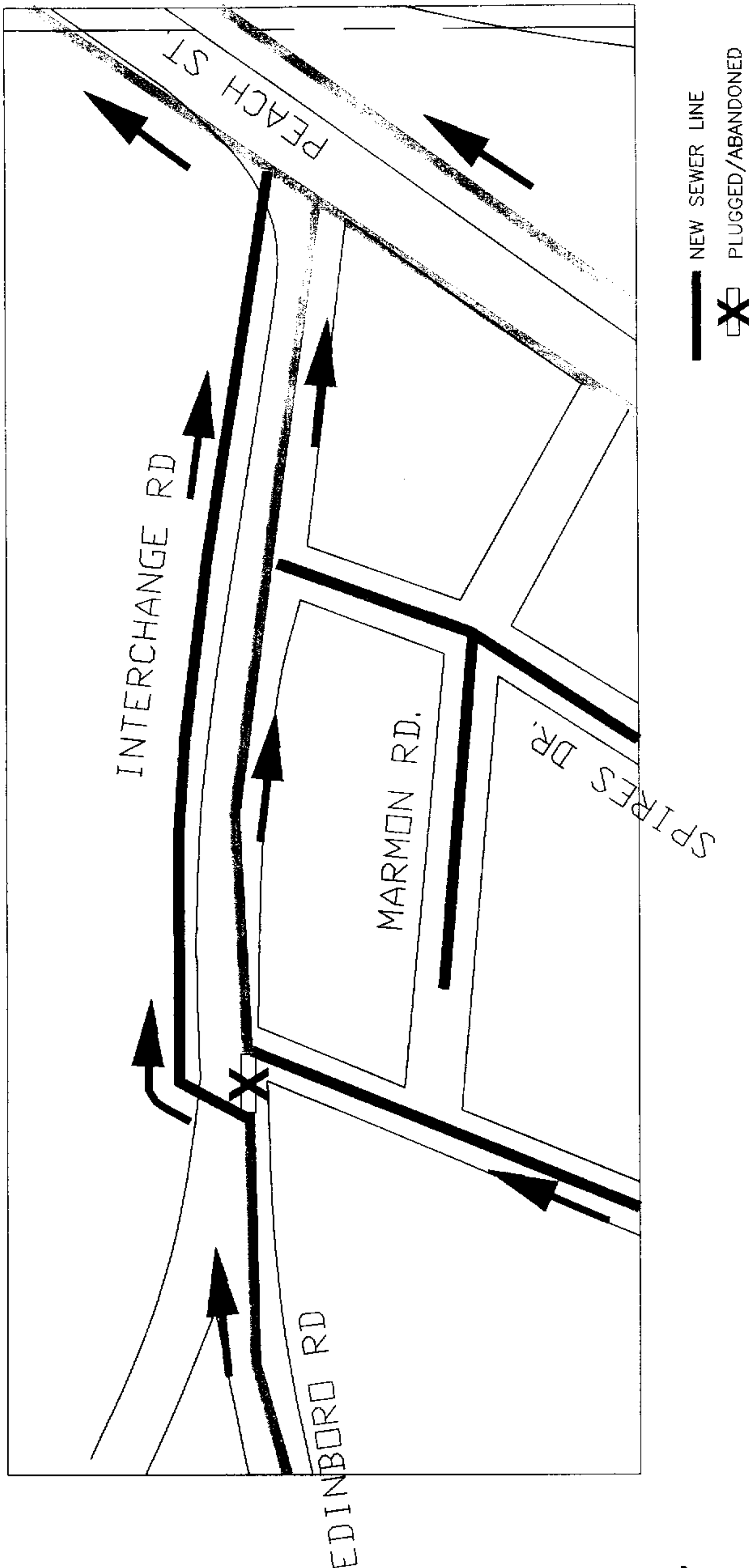
It is impossible to guarantee that the improbable will not occur. Thus, it is recommended that individual backflow preventers be provided on the service lines to users who may be flooded by backups due to station flooding. Thirty-nine such units have been identified.

B. **Management Alternatives**

The management program will remain as presently defined. The MTSA will continue to operate, maintain, and fund capital improvement programs and Summit Township Sewer Authority will be invoiced based on their percentage contribution to recover those costs.



SECTION B: Zimmerly at W. 51st St



SECTION D: Interchange Rd at Peach St

FIGURE x-g

C. Comprehensive Planning Alternatives

No modification of existing Comprehensive Plans are needed.

D. No Action Alternative

If no action were taken, existing overflows would continue both in the sewer system and at the station. Backups and basement flooding would continue. Development would stop since capacity would not remain for the increased flows. Basements would continue to be flooded periodically. The station would remain marginally effective in its operation requiring a high degree of manual manipulation. No other impacts are expected.

XI. EVALUATION OF ALTERNATIVES – KEARSARGE PUMP STATION

A. Evaluation

Pump Station Upgrade

The equipment upgrade needs include:

Pumps: Existing pumps are performing well but are getting old particularly the motors. Pump #1 motor has been running hot and the pump plugs consistently. Both pumps are long shaft. If replaced, dry well submersibles should be used to reduce maintenance and give more room on the ground floor.

Pump #3 is a constant speed unit and adds little to the operation of either of the two larger head pumps. Although at low heads it can produce 2,000 gpm when running in conjunction with one of the two variable speed units, its productivity is limited with its output reaching only 400 to 500 gpm. It should be replaced with a unit identical (or larger) to the other two so it will operate as a standby (10 State Standards) and will contribute more in an emergency situation.

Meters: The existing meter is recording low volumes and needs adjusted. That effort has been delayed until ending the present assessment so as not to complicate the evaluation by any additional changes. This unit is a sonic meter and should be replaced with a more reliable magmeter. However, this effort will be complicated by the need to bypass the 16-inch force main to allow for installation and the ultrasonic unit is an acceptable alternative.

Automatic Transfer Unit: The unit allows the automatic transfer of power from the utility to the generator when there is a power failure. Presently when power is lost, maintenance personnel must

travel to the station, start the generator and manually transfer the power supply. Since the wet well is small, the time required allows the wet well to surcharge to high levels. This unit will significantly lessen this time interval and should prevent the station being down long enough to surcharge to ground level (at 4,000 gpm it would take 10 minutes).

Generator: The existing generator will only generate sufficient electricity to operate two of the three pumps. It is not provided with an automatic transfer switch and recent attempts to do so were frustrated when it was determined that manual manipulation of the unit was required to make a successful power switch. The existing unit is a diesel unit and is loud. The unit should be replaced with a larger gas operated unit (to allow the larger unit to fit and to alleviate any concern over the availability of fuel). The ventilation in the garage will need to be replaced and automated so that the unit can initiate and run without an operator in attendance. The automatic transfer switch should be placed in the garage to increase room in the station. The main power lead to the station will need to be relocated to the garage.

SCADA: The station is a major unit in the operation of Millcreek Township sewer system. A computer aided monitoring and control system will allow problems to be uncovered quicker and operation data to be assessed and assembled quicker.

Odor: There was a substantial number of complaints received on odor from this station. Odor reduction equipment along with improvements to the wet well ventilation must be part of any upgrade.

Flows

In deciding what design event to use, one must determine what assurances are desired against an overflow. As stated, no storm frequency of less than one year has occurred during wet or saturated conditions. In fact, only one 0.5 inch and one 0.75 inch has occurred in the normally wet periods of December through April during the ten years of precipitation data reviewed. However, several events, including the base overflow event, did occur outside that period when several days of rain saturated the soil causing overflows. Substantial rain events do occur in these periods. In fact, the largest recorded in the ten years investigated (a 50 to 25-year event) occurred in September (that event, because it was not associated with an earlier event or saturated soils, caused no overflow, although flooding was wide spread throughout the City). Had that event followed the 2003 event, 740,000 gallons of storage would have been necessary. Likewise, perhaps the worst overflow event recorded was in August, 2000, when first a one-hour 1-year event followed by a second saturated the soil so that the third (all within a five hour time

interval) one-hour event caused sufficient flows to create an estimated 5,000 gpm flow. While this storm could have easily been handled with 4,500 gpm of pumping capacity and 150,000 gallons of storage at the time of its occurrence, if it had occurred during a period with saturated or frozen soils, 1,740,000 gallons of storage would have been required.

Pump Station

Alternate A - Minimize pumping and storage requirements:

Expanding the pump station pumping capacity to the limits of its existing force main/pump pumping capability. This will not allow sufficient additional capacity to handle existing observed overflows plus ten-year growth. Storage volumes equal to that which would have been necessary now for the September and March overflows will still be necessary in ten years. There will only be a net gain of 300 gpm forward flow capacity within ten years. Any lesser storm frequencies (higher intensity) chosen for design will require the storage selected to be enlarged. In the future the option will remain to expand the force main and increase pumping capacity. Forward flow will be increased from 3,600 to 4,500 gpm. If I&I efforts are successful and significantly lower the influent flows, flows transferred forward can be minimized.

Effort:

- Replace three pumps with 4,500 gpm units
- Construct storage pumping station
- Construct storage tank

Pro's:

- Will manage and both pass and store peak flows and additional growth through 2014.
- With experience may divert lesser peaks to storage thus lowering City peaks if storage is not needed for precipitation caused event.
- Will minimize peak flows observed downstream by shaving peaks
- Will allow for consideration of other contingency events commingling with base storm by increasing size of planned facilities (storage pumping and tank) plus forward flow increases.
- Will provide additional duplication to protect against flows which may be unanticipated due to severe weather (i.e. two standby pumps, one to storage and one to the City will be available).
- Will allow for pumping increase as an alternate to storage in 2014.
- Pump variable speed range covers low and high flow observations.

Con's:

- Higher cost
- Esthetics – odors and visual
- Benefits for successful I&I abatement
- Ultimate flow alternatives will need to look at repetitious construction

Alternate B – Maximize Forward Pumping:

Expanding the pump station's pumping capacity to accommodate the 10-year design flow utilizing peak flows equal to those observed over the past ten years. Construction will include increasing both force main and pump capacity to the extent the physical constraints of the existing station will allow. Future construction will be required in ten years to accommodate future growth. Station ultimate flows will be limited by suction capacity. The success of the I&I program will dictate the capacity needed following ten years. If this treatment is to consider flows or storms greater than the suggested base storm (this storm occurred within the confines of the observation periods: September, 2003) then storage will be required. Forward flow will be expanded from 3,600 gpm to 5,500 gpm.

Effort:

- Replace three pumps with 5,500 gpm units
- Reconstruct force main
- Storage for contingencies only

Pro's:

- Will manage and pass existing observed peak flows (warm and cold seasonal) plus additional growth through 2014
- No storage required for base storm event thus minimizing esthetic problems and operational problems associated with such units
- Least cost
- Allows time to assess impact of I&I abatement
- Will meet 10 State Standards

Con's:

- Does not provide for contingency flows associated with commingling of storm events (standby pumps will have minimal impact on flow rate if called upon to operate with the two main units).
- Providing for contingency events will require storage minimizing cost savings.
- Pumps will pass 1,700 gpm (2.5 MGD) more flow than previously accomplished (with surcharged wet well) to the City further compounding agreement violations.

- Will require off site construction to enlarge force main.
- Limited response to unanticipated peak flow due to severe weather events.
- Pump variable speed flow range will not accommodate both minimum and maximum flows.

Alternate C – Maximize Storage:

Storage only will require the construction of large storage facilities to handle storm induced flows and flows due to growth. The units will be large and unsightly. Ultimate growth alone will require 600,000 gallons of storage.

Effort:

- Replace pump #3 with one of equal capacity to pumps #1 and #2
- Construct storage pumping
- Construct storage tank

Pro's:

- Does not impact forward flows or City agreement
- Allows for future ultimate flow to be managed by increased pumping only
- Allows for consideration of contingency events by increasing size of planned facilities
- Pumping range is well established as being optimum
- Least amount of pump station modifications
- Operating costs minimized (charges)
- Station emergency forward capacity will be marginally improved with larger #3 pump
- Allows benefits of successful I&I to be applied to units affecting operating costs

Cons's:

- Storage only, single duplication, least flexible
- Largest cost
- Largest negative esthetic impact

It is not believed that the concerns of the Authority, the PA DEP, and concerned citizenry will be met if plans are not made for an overlap of peak storm events resulting in higher flows being imposed on the base peak flow event. Thus, it is believed that storage of at least 200,000 gallons will be required regardless of the forward pumping alternate selected.

Sewers

There is little need for investigating a zero or no change alternate for two of the three sewers tributary to the pump station. They obviously require relief through either reduction in flows or diversion of flows.

Diversion of flows is positive and leaves no doubt on the impact of the effort. Diversion to storage, however, is not considered an option due to the limited area available near the problem areas which would allow a self-initiating unit to be constructed. This leaves relief sewers or use of extra capacity in existing sewers as the acceptable alternate. If relief is used, some have expressed a concern that the flow rates will be increased at the station. If sewers presently surcharge and do not overflow, then that surcharge will now force the higher rate through the sewer and there will only be minimal increases noted.

The second alternative is flow reduction via I&I abatement. It is not a means whereby a final result can be assured, but it is a more environmentally friendly means since the flow rate will be reduced and extraneous flows will not need treated. Where time is available, it is best to await the results of an I&I abatement program, but since results are not guaranteed if time is not available, it is best to proceed with relief.

Time is not available in the two Millcreek sewers shown to be overloaded. The DEP has decreed that I&I abatement not be depended upon to impact the results of the plan's recommendations.

Zimmerly Road Sewer (10-inch)

This sewer needs relieved immediately. Existing flows are greater than the sewer capacity. Since only one relief alternative is available, it should be constructed now and at a size which will accommodate ultimate flow loads rather than await the results of the flow abatement. Abatement efforts should continue since flow reduction will benefit the Authority at the pump station in ten years when further expansion is considered.

Beaver Run Sewer (18-inch)

This sewer, like the 10-inch, needs immediate relief. Two areas are able to be diverted away from the Beaver Run sewer making up an estimated 30% to 40% of the 18-inch ultimate flow. Only one needs done immediately to relieve the sewer sufficiently to prevent flooding and thus it is recommended to do the easiest and least expensive which is to divert the flows in the Route 19 sewer (10-inch) south of Walnut Creek to the 24-inch mall sewer. This effort can be accomplished by constructing no more than 1,000 ft. of sewer and two connections to existing manholes. The second area which can be diverted is the Kuntz Road sewer but its diversion will be much more difficult and costly requiring a pump station and creek crossing. This diversion may be needed for ultimate flow conditions. It is best to await I&I abatement results.

Beaver Valley Sewer (12-inch)

This sewer was expanded to a 12-inch unit in 1967 by crushing the old sewer. It now has sufficient capacity to accommodate existing flows. No significant future flows are projected and if a surcharge is not imposed on it by the downstream 18-inch, capacity is sufficient. Its capacity is entirely used, however, and flow abatement efforts now under way by the Authority are needed to give some measure of a safety factor.

Interchange Road Sewer

This sewer presently has a capacity of 1.45 MGD and has sufficient capacity through 2014 and beyond. However, there is significant area for growth in Summit with possible ultimate flows of 1.3 MGD. This sewer should be revisited in 2014 but need not be relieved presently.

Miscellaneous

Even if all upgrades and expansions are put in place, automatic emergency power transfer, duplicate pumping facilities and standby pumping, peak flow storage, emergency gravity storage, etc., basement backups remain a possibility. Catastrophic flows in conjunction with pump station failures could lead to wet well flooding. Placement of backflow prevention valves in homes whose basement elevations are below the ground elevation of the pump station are recommended. These are not 100% effective particularly if not maintained, but they will limit damage in the event of a catastrophic event.

Storm Contingency Amounts

The storms and overflow events reviewed have demonstrated that the frequency of a storm event's occurrence is not a good judge of an overflow occurrence. Many more environmental features are involved which impact on flows at the pump station increasing to the extent that an overflow is created. Chief among these is soil saturation or imperviousness. Observations have shown that large storms (50-year frequency) have not resulted in overflows during dry or unsaturated soil conditions.

Also, it has been demonstrated that storm events having a frequency of 1-year or less have not been observed to occur during normal periods of saturated soils, December through April. Atmospheric conditions simply do not support large intensity storms during that time.

Finally, it has been demonstrated that only one of the overflows since 1992 was associated with a storm event with a recurrence frequency equal to or less than 1-year and that event is controllable if interpreted as a dry weather event only.

Needed capacities have been developed by transposing dry weather storm flow impacts onto wet weather overflow events. Pumping and storage capacities were given for 1-year, 50-year, and the event incorporating three 1-year storm events believed to have been better described as a wet weather 1-year event and allowed to stand alone without transposing it. It is believed that it is possible that a 1-year event (approximately 1-inch/hour) will and can occur in a wet period (one 0.5-inch/hour and one 0.75 inch/hour rainfall have been observed in the period December to April in the ten years examined). It is also believed highly improbable that any lesser frequency storm will coexist with a wet weather event.

Even were a 50-year event to occur during a period of saturated soils, the station design can be structured to allow all three forward pumps to operate to transfer additional flows forward or to allow standby storage pumps to operate in conjunction with the normal pumps to transfer additional flows to storage if capacity remained. If the storage was empty at the time of the 50-year event, all but 40,000 gallons could be contained which would limit the surcharge to elevation 317 ft. vs. ground level of 317.5 ft. (back flow preventers are to be installed to protect against a surcharge of up to 320 ft.).

B. **Consistency Determinations**

The above plans are considered consistent with the following environmental and municipal planning tools and guidelines.

1) Clean Streams Law & Clean Water Act Plans – Plans approved under these acts included the Water Quality Management Plan of 1972, the Millcreek Act 537 Plan of 1996 and the Erie City Act 537 Plan of 1998. These plans all called for the treatment of municipal wastes from this area at the Erie Wastewater Treatment Plant. All alternates presented comply with these plans. The one inconsistency is that the Water Quality Management Plan called for the area to be limited to the Lake Erie watershed. The Summit service district extends slightly south of that boundary to encompass an area supplying Lake Erie water. The purpose being to bring that water back to the Lake Erie watershed.

2) Consistency with Municipal Wasteload Management Plans – All effluent is to ultimately be discharged to the Erie Wastewater Treatment Plant which contains sufficient capacity for the increased load. Past plans called for 14.3 MGD of flow from this station with a capacity of 16.9 MGD available in the Pittsburgh Avenue sewer. Present plans call for between 5.1 MGD and 7.92 MGD from the station. There have been periods of exceedances of flows included in the City/township agreements but there have not been any overloads reported. However, they may result in fines.

3) Consistency with Comprehensive Plans – All such plans call for wasteloads in these areas to be transported to the Erie Wastewater Treatment Plant. The Millcreek Comprehensive Plan encourages expanding sewer lines into undeveloped or unserviced areas. These alternates implement that.

4) Antidegradation Requirements – The alternates, other than the zero action alternate, are all to accommodate peak flows eliminating the need for overflows which will improve water quantity no matter how minutely.

5) State Water Plan – This plan calls for minimizing the use of onlot disposal and discharge of improperly treated wastes into our water resources. The study alternates do that.

6) Pennsylvania Prime Agricultural Land – Very little of this land remains undeveloped within the Kearsarge pump station service district. There is no impact.

7) Storm Water Management Plan – Inasmuch as this plan recommends the continuation of the I&I abatement, storm water flows found in the sanitary sewers may ultimately be rerouted to the surface compounding problems. This cannot be avoided but may require additional storm water facilities.

8) Wetlands – There are no mapped wetlands in the Kearsarge pump station construction area but observations are that they may exist in the vicinity of one of the alternate storage facilities' sites. A study has been completed which shows wetlands near the eastern alternate site which has been partially responsible in conjunction with mapping of the floodplain in eliminating that site.

The study, however, shows the western site to be free of wetlands. The full study is found in Appendix B-1 and additional discussion is found in Appendix A-3 Elevated Tank Environmental Assessment.

9) Floodplains – Although maps show that neither of the two sites proposed for construction lie in the floodplain, there has been sufficient nearby construction (Millcreek Mall) that it is suspected that the flood plain may have been altered sufficiently to impact that same alternate site and its access. A study has been completed to show that to be true.

The attached Figure XI-a is a partial map of the floodplain mapping showing the western site. The proposed storage tank is located outside the 100-year floodplain and partially within the 500-year floodplain which is permissible. The floor of the aboveground tank foundation is located at the 500-year flood elevation to prevent flooding up the wall of the tank and allow access to the tank from the west. The floodplain study is found in Appendix B-1 and the floodplain is further discussed in Appendix A-3.

10) Rare and Endangered Species – A PNDI search is complete. No rare or endangered species were noted. The comments are found in Appendix A-2.

11) Coastal Zone Management – The area is not in the coastal zone.

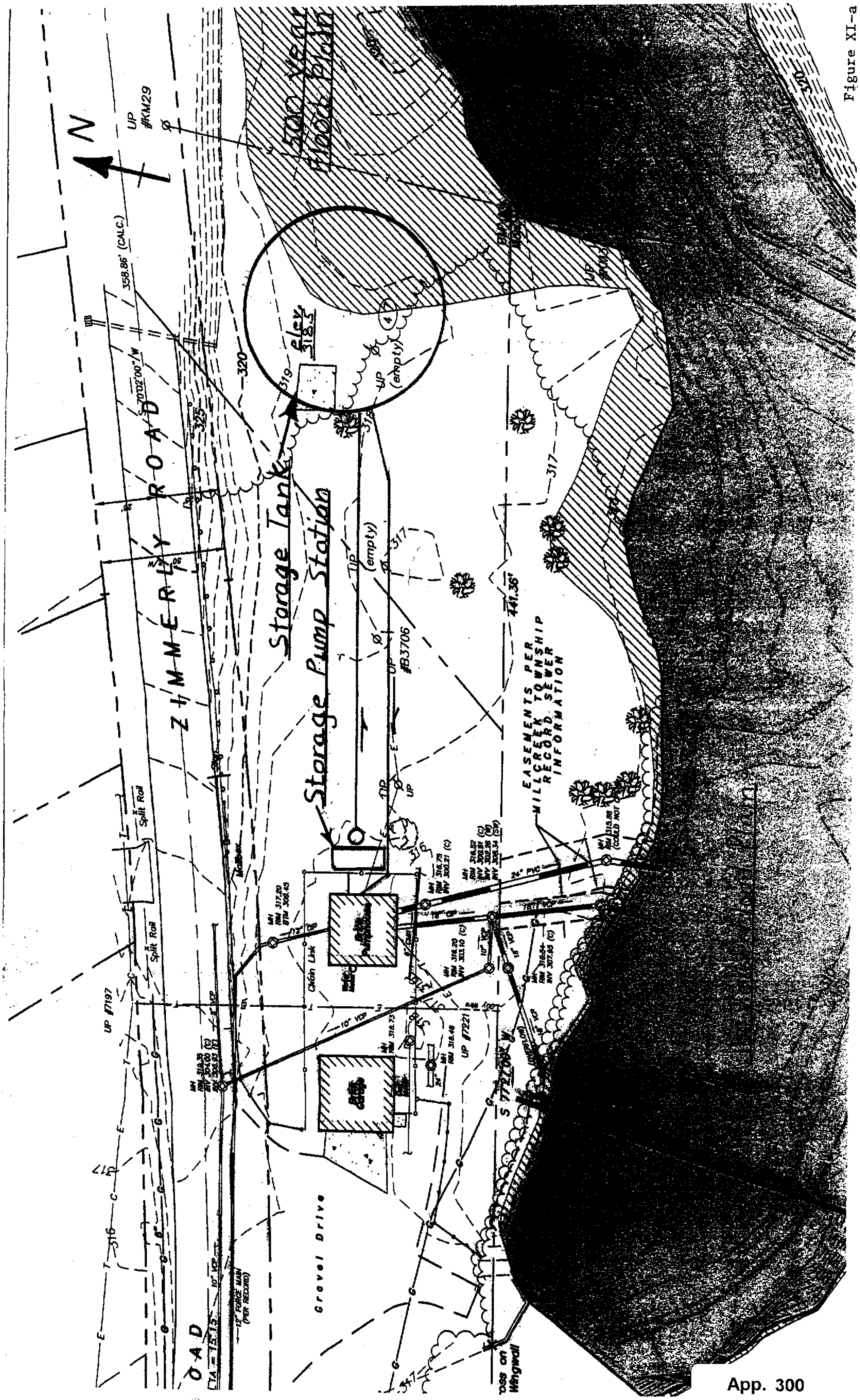


Figure XI-a

MSA-MT 2253